

Advancing the Study of Amerindian Ecodynamics in the Caribbean: Current Perspectives

Michelle J. LeFebvre, Christina M. Giovas & Jason E. Laffoon

To cite this article: Michelle J. LeFebvre, Christina M. Giovas & Jason E. Laffoon (2018): Advancing the Study of Amerindian Ecodynamics in the Caribbean: Current Perspectives, Environmental Archaeology, DOI: [10.1080/14614103.2018.1505224](https://doi.org/10.1080/14614103.2018.1505224)

To link to this article: <https://doi.org/10.1080/14614103.2018.1505224>



Published online: 17 Aug 2018.



Submit your article to this journal [↗](#)



Article views: 5



View Crossmark data [↗](#)



Advancing the Study of Amerindian Ecodynamics in the Caribbean: Current Perspectives

Michelle J. LeFebvre ^a, Christina M. Giovas ^{b,c} and Jason E. Laffoon ^{d,e}

^aDepartment of Natural History, Florida Museum of Natural History, Gainesville, FL, USA; ^bDepartment of Archaeology, Simon Fraser University, Burnaby, Canada; ^cDepartment of Anthropology, University of Oregon, Eugene, OR, USA; ^dFaculty of Archaeology, Leiden University, Leiden, Netherlands; ^eFaculty of Science, Vrije Universiteit, Amsterdam, Netherlands

ARTICLE HISTORY Received 18 July 2018; Accepted 20 July 2018

KEYWORDS Zooarchaeology; archaeobotany; geoarchaeology; biochemistry; Caribbean; human ecodynamics

Introduction

Worldwide, archaeological research is increasingly demonstrating the antiquity and complexity of interactions between human groups and the environment. In the Caribbean, this complexity is underscored through environmental archaeology studies that reveal how past landscapes and seascapes have been shaped at multiple scales by interlinked cultural and ecological systems. The analytic methods of zooarchaeology, archaeobotany, geoarchaeology, and biochemistry have become powerful tools to understand these dimensions of connectivity. This special issue of *Environmental Archaeology: The Journal of Human Paleoecology* examines pre-Columbian human social and ecological relations across space and time in the Caribbean based on various environmental and biogeochemical proxy records. The articles included were originally presented during a symposium sponsored by the Island and Coastal Archaeology Interest Group at the 2016 Society for American Archaeology Annual Meeting in Orlando, Florida. Collectively, these papers exemplify progressive methodological and theoretical approaches in environmental archaeology and the study of past human ecodynamics. They demonstrate the importance of contextualising environmental archaeological datasets within broader issues of anthropological and ecological significance, including patterns and consequences of human mobility and interaction, animal translocations, anthropogenic influences and manipulation of island biota, and the links between ecosystem and human social variability.

In this introduction to the special issue, we broadly characterise environmental archaeology as the study of past relationships between ‘people, cultural institutions, and ecosystems’ (Reitz and Shackley 2012, 1) in an effort to understand a range of environmental and social phenomena through time and across space. Our use of ‘human ecodynamics’ is based on

James McGlade’s (1995) definition and Patrick Kirch’s (2008) use of the term to refer to an interactive perception of humans and their environment, where a human-ecodynamic approach ‘is concerned with the dynamics of human modified landscapes set within a long-term perspective, and viewed as a nonlinear dynamical system’ (McGlade 1995, 126). Used in this way, human ecodynamics provides a conceptual framework for summarising environmental archaeology research in the Caribbean and its contributions to our understanding of past human behavioural responses to the constraints and opportunities presented by the region’s diverse environments and biota.

The following section provides an overview of this special issue’s environmental and cultural historical focus and the nature of the landscape experienced by Amerindians. We then review how environmental archaeology has contributed to our understanding of pre-Columbian Amerindian lifeways and ecodynamics, as well as larger archaeological and anthropological questions. Finally, we discuss the contributions made to this discourse by the authors of this collection of papers.

The Caribbean Archipelago

The Caribbean archipelago is an arc of thousands of islands and cays extending from The Bahamas, in the Atlantic Ocean, to the Greater and Lesser Antilles, which bracket the Caribbean Sea. The islands off the northern coast of South America are generally included among the Caribbean cultural area, although those lying off eastern Central America are not (Figure 1). Caribbean islands vary in their geology, from carbonate to continental and volcanic, and exhibit dramatic diversity in size, land form, weather patterns, ecology, flora, and fauna. Designated a global biodiversity hotspot (Myers et al. 2000; see also European Commission on Caribbean and Bermuda: <http://ec.europa.eu/envir>



Figure 1. Map of the greater Caribbean Archipelago and surrounding continental mainland.

onment/nature/biodiversity/best/regions/caribbean_en.htm), the Caribbean archipelago and surrounding seas are home to some of the world's most ecologically sensitive habitats and feature high rates of endemism, with abundant local and regional level records for endangered, extirpated, or now extinct plants and animals.

According to conventional models, the Caribbean was peopled from Central and South America in three migration waves: (1) Pre-Arawak cultures (so-called Lithic and Archaic groups) around 4000–400 BC; (2) Ceramic Age cultures between approximately 500 BC to AD 1500; and (3) Europeans and enslaved Africans starting in 1492 (Keegan and Hofman 2017; Rouse 1992; Wilson 2007). Archaeological evidence indicates that pre-Columbian people and communities across the islands were diverse in terms of social organisation, environmental settings, and settlement layout. Subsistence economies throughout the region were based on variable practices, including fishing, shellfish gathering, hunting, plant gathering, and farming (deFrance 2013; Newsom and Wing 2004; Reid 2018). Prehistorically and historically, the region was marked by a high degree of intra- and inter-island movements and interaction networks, as well as interactions and relationships with surrounding circum-Caribbean mainland groups (Hofman et al. 2007, 2008; Hoogland, Hofman, and Panhuysen 2010; Laffoon et al. 2017; Mol 2013; Rodríguez Ramos and

Pagán Jiménez 2006). These interaction networks facilitated the movement and exchange of material goods, such as lapidary and ceramic artefacts, continental animals, plants, and people (Fitzpatrick et al. 2009; Garcia-Casco et al. 2013; Giovas 2018a; Giovas, LeFebvre, and Fitzpatrick 2012; Giovas et al. 2016; LeFebvre and deFrance 2014, 2018; Lord et al. 2018; Pagán Jiménez 2013; Pagán Jiménez et al. 2015; Schroeder et al. 2018). Human paleomobility, for example, is evident in isotopic studies showing ubiquitous, yet highly variable, flows of migration into and within the Caribbean at multiple social, geographical and temporal scales (Booden et al. 2008; Hoogland, Hofman, and Panhuysen 2010; Laffoon 2012, 2013, 2016; Laffoon and Hoogland 2009, 2012; Laffoon et al. 2012, 2013, 2017, 2018; Schroeder et al. 2009, 2014; Valcárcel Rojas et al. 2011). While the geographic focus of this special issue is the Caribbean archipelago, several articles address interactions with and influences from continental-based groups of people and biota.

The Caribbean and Environmental Archaeology

Environmentally derived datasets have long been the focus of research in Caribbean archeology. The regionally famous 'Crab-Shell Dichotomy', first noted by Froelich Rainey in 1940, is a case in point. This term describes the apparent shift from crab to shell

dominated strata at archaeological sites on Puerto Rico around the time of onset of the Ostionoid (cal AD 600). This observation has inspired longstanding debates over the cause, which has been ascribed to the presence of two different cultures and the arrival of new South American migrants cal AD 600 (Rainey 1940), dietary seasonal variability among one culture through time (Rouse 1992), overexploitation of crabs resulting in a shift to mollusc exploitation (deFrance 1989), climate changes (e.g. drier conditions limited crab availability through time) (Carbone 1980), and differences in dietary preferences between communities through time (Keegan and Hofman 2017). Today, most scholars attribute these shifts to a complex array of environmental and social factors linked to flexible regimes of terrestrial and marine exploitation as well as socio-political changes (Keegan and Hofman 2017; Rodríguez Ramos 2005; 2010).

Also in the 1940s, pre-Columbian faunal records in the French Antilles received scholarly attention (e.g. Chabanaud 1946; Friant 1941; Hoffstetter 1946 as cited in Grouard 2010), and by the late 1960s through the 1980s zooarchaeological analyses were increasing across the region (e.g. Wing 1961, 1962; Wing and Reitz 1982; Wing and Scudder 1980; Wing, Ray, and Hofman 1968), as were paleobotanical and soil studies (e.g. Newsom 1988; Pearsall 1985, 1989 as cited in Newsom and Wing 2004). Thus, in the broadest sense, there has never been a shortage of environmental archaeology in the Caribbean.

Over the last two decades, in particular, environmental archaeology has contributed keystone insights to some of the most topically compelling and methodologically advanced research agendas in the Caribbean. For example, zooarchaeological, paleobotanical, chronometric, isotopic, and ancient genetic datasets are increasingly used to reveal patterns of island biodiversity through time, including processes of taxon and habitat extinction and persistence, biotic introductions, as well as landscape changes (e.g. Bochaton et al. 2015; Boudadi-Maligne et al. 2016; Giovas 2018a, 2018b; Giovas, LeFebvre, and Fitzpatrick 2012; Grouard 2002; Newsom and Wing 2004; Perdikaris et al. 2018; Pérez Iglesias and Valcárcel Rojas 2014; Pestle 2013; Siegel et al. 2018; Steadman and Stokes 2002; Steadman, Pregill, and Olson 1984, 2017; Stouvenot et al. 2014). These data are also used to investigate possible migration routes and origins of people, animals, plants, and cultural practices; and they indicate long-term relationships of interaction cross-cutting the circum-Caribbean region as a whole (e.g. Giovas 2018b; Hofman, Rodríguez Ramos, and Pagán Jiménez 2018; Kimura et al. 2016; LeFebvre and deFrance 2014, 2018; Laffoon et al. 2014, 2015, 2016; Lord et al. 2018). Geoarchaeological and paleoenvironmental datasets contribute to broader understandings of anthropogenic landscapes and cultural responses to

climatic variability through time, including responses to sea level fluctuations, hurricanes, and weather patterns (e.g. Beets et al. 2006; Cooper 2013; Lane et al. 2014; Rivera Collazo 2011; Siegel et al. 2015). Accordingly, these data, along with ethnohistoric and ethnographic records (e.g. Antczak 2018; Deagan 2004; Keegan and Carlson 2008; LeFebvre 2015; Reitz and McEwan 1995; Wallman and Grouard 2017), are used to deduce how changes in biota as well as ‘natural’ and anthropogenic landscapes articulated with settlement patterns, subsistence strategies, social organisation, political economy, and ritual practices over time and space.

In sum, environmental archaeology in the Caribbean has a long history of multidisciplinary research agendas that underscore the interconnectedness of anthropological, biological, environmental, and historical questions. Across the region, interdisciplinary research teams conduct methodologically robust studies that provide long-term perspectives on Amerindian, Colonial, and Post-Colonial ecodynamics and social relations in coastal, island, and continental landscapes.

Pre-Columbian Caribbean Environmental Archaeology: Common Threads and Article Overviews

The articles in this issue share overarching themes that underscore Caribbean environmental archaeology as a practice of linked interests and goals, and provide a basis for disciplinary advancement within the region and beyond. Methodologically, all articles in this issue draw on various analytical combinations of interdisciplinary datasets, including zooarchaeological specimens, geochemical signatures, ethnohistorical records, as well as environmental modelling. Several studies offer thoughtful discussions regarding methodological challenges and advances as well as interpretive potentials of environmentally derived datasets. Moreover, the articles demonstrate the importance of both micro- or local-scale studies of single sites or islands, and macro- or regional-scale studies including multiple islands. As has been demonstrated in other regions, and particularly among island settings, the interplay of different scales is necessary for identifying patterns of natural and human systems across ecologically sensitive and culturally diverse landscapes (e.g. Lambrides and Weisler 2017; Otaola et al. 2015).

In a theoretically oriented contribution, Morsink argues that the metaphor of catalytic environments provides a framework through which archaeologists can identify and analyse the dialectical relationship all humans share with their surrounding environments. Drawing on archaeological evidence of fishing, salt exploitation, and cotton cultivation at the Lucayan site of MC-6 (ca. AD 1300–1650) located on Middle Caicos Island (Turks & Caicos Islands), as well as

data on pre-Colonial exchange networks and the natural cycles of salt and cotton availability, Morsink models an annual cycle of economic production at the site as an example of how archaeologists can mitigate interpretive tensions between human agency and environmental constraints.

Using legacy zooarchaeological collections curated at the Yale Peabody Museum of Natural History, Colten and Worthington report on patterns of vertebrate exploitation across three Archaic Age sites on Cuba, dating from 350 BC to AD 630. Their findings indicate that Archaic groups practiced taxonomically diverse hunting and fishing strategies across multiple habitats. Owing to a dearth of prior investigation, Colten and Worthington's study contributes important new data to Caribbean Archaic Age zooarchaeology, particularly for Cuba. It also underscores the great potential in collections-based studies and the importance of maintaining museum curated environmental archaeological assemblages.

Giovas reviews the current state of mammal translocation studies in the pre-Columbian Caribbean. While as many as eight or more non-native mammals may have been introduced to the islands from the continental Americas, knowledge of translocation routes, timing, and dispersal mechanisms is limited by a lack of direct dates on specimens and underreporting of finds. Synthesising records across the region, she argues for the need to distinguish the introduction of live animals from that of animal products in the archaeological record and calls for improved chronological control of species translocations. These data, along with enhanced understanding of the social role and contexts of use of introduced animals are ultimately important to determining the ecological legacy of faunal translocations and their importance in Amerindian adaptation to insular environments.

LeFebvre and colleagues provide a synthesis of pre-Columbian Bahamian hutia (*Geocapromys ingrahami*) archaeological records from Late Ceramic Age (cal AD 700/800–1500) sites in the Bahama archipelago. The results of new analyses are presented, including morphometric data and evidence of translocation to an island previously uninhabited by hutias. The authors use the data to discuss challenges of archaeologically demonstrating human manipulation and management of wild taxa.

Laffoon and colleagues investigate the nature of human-dog relationships in the ancient Antilles using a unique combination of strontium and carbon isotope analyses of dental enamel samples from sites on Guadeloupe and the Dominican Republic. Their approach aims to explore the dynamic relationships between humans and dogs and how these may have varied over space and time in terms of both dietary and mobility patterns. The results demonstrate a generally high degree of correspondence between human and dog

dietary patterns, and similar rates of mobility (and possibly similar origins of nonlocal individuals) across different site contexts. The study, furthermore, highlights both the enormous potential for expanding isotope analyses to novel research questions and strategies, but also the need for larger and more representative datasets for making meaningful comparative analyses.

Antczak and colleagues examine archaeological bird assemblages from late pre-Columbian contexts (cal AD 1000–1500) in Venezuela's offshore islands. These assemblages are unusual among Caribbean zooarchaeological collections for their avifaunal specimen abundance and species richness. Seeking to understand the roles of birds among Amerindian societies, the authors examine factors affecting the recovery of bird remains, contexts of specimen discard, seasonality of site occupation, bone modification, and use of bone and feathers in personal ornamentation. They contrast the contemporary biogeography of species encountered with that suggested by the zooarchaeological record to identify anthropogenic influences on the distribution of avifauna in the region, finding that the differentiation of nesting grounds between brown (*Sula leucogaster*) and red-footed boobies (*Sula sula*) in the Southeastern Caribbean may be a response to past human activity.

Employing marine faunal datasets, Crock and colleagues explore variations in fishing practices amongst Late Ceramic Age settlements (cal AD 900–1200) on Anguilla in the northern Lesser Antilles. Rather than conducting simple comparisons of datasets from different sites, this study uses a predictive model based on bathymetry and local marine habitats to estimate the fish species most likely to have been targeted by prehistoric fishers. The authors use these estimates to investigate variations in 'marineness' between these ancient communities. Marineness is defined as the inter-relationship between people and the unique composition of marine resources and underwater seascape adjacent to their villages. The habitat-based model provides reliable predictions of which taxa were the most targeted at different sites and the overall results indicate the importance of local fisheries while emphasising the potential role of variations in fishing habitats and practices for the construction of local identities.

Relying on large-scale invertebrate faunal records explicitly linked to a newly generated paleo-climatic framework for St. Martin and surrounding islands, Serand and Bonnissent present an ambitious study of the long-term interactions of anthropic and natural systems in the northern Lesser Antilles. The study represents an innovative approach to synthesising large zooarchaeological datasets across different assemblages at multiple spatial scales – from site, to island, to archipelago – spanning the cal fourth millennium BC to the end of the Late Ceramic Age. While cognizant of the limitations of both the archeofaunal and paleo-

environmental datasets, the authors make a compelling case for strong chronological associations in changing patterns of invertebrate faunal resource exploitation possibly linked to other apparent changes in socio-economic systems. This study provides important new data and nuanced insights on ongoing debates in Caribbean archaeology, such as the supposed Crab-Shell dichotomy, while stressing the potential role of short and long-term climate change as a driver of changing ecodynamics in the Caribbean.

Concluding Thoughts

As exemplified in this special issue, Caribbean environmental archaeology is a research area of dynamic and varied inquiry into multiple aspects of the human-environment relationship through time. The questions and considerations pursued by the authors of this issue are relevant not only to the Caribbean and Latin America, but more broadly to our understanding of human eco-dynamics on a global scale. For example, the work of LeFebvre et al. illustrates the complexities of defining and recognising animal management in the archaeological record and its relationship to domestication. Similarly, the contributions by Colten and Worthington, Giovas, and Serrand and Bonnissent demonstrate the paramount importance of chronological control to valid reconstructions of anthropogenic environmental modification.

Still, not all potential topics could be addressed. Although the original symposium comprised pre-Columbian and Historic Era (post-1492) studies, for instance, the collection of papers featured in this issue primarily focus on pre-Columbian Amerindian archaeological contexts (see Serrand and Bonnissent for an exception). Readers will also note the absence of contributions addressing paleobotany, although as demonstrated by another recent *Environmental Archaeology* thematic issue on the environmental legacies of colonialism in the northern Neotropics, this is an active research area in the Caribbean (Wallman, Wells, and Rivera-Collazo 2018; see also *Environmental Archaeology* Vol. 23, 2018).

In addition to showcasing the topical, methodological, and interpretive breadth of environmental archaeology practiced in the Caribbean, the diversity of datasets and interpretations presented across this collection of papers suggest that Amerindian ecodynamics were primarily influenced by (1) heterogeneous combinations of intra- and inter-island environmental and ecological variability; (2) dynamic networks of social interaction; and (3) differential anthropogenic impacts on surrounding biota. Continuing to employ and advance interdisciplinary methods of analysis, engaging with multi-scalar perspectives of human behaviour and practices, and producing fine-grained chronologically sensitive environmental data sets will

help us to better elucidate how variable patterns in Amerindian ecodynamics articulated with long-term trends in and links between environmental conditions and human practices throughout the region.

Acknowledgements

We gratefully acknowledge the participants of the 2016 SAA symposium: Nancy Albury, Andrzej Antczak, Marlana Antczak, Mary Jane Berman, Dominique Bonnissent, Lisa Park Boush, Nanny Carder, Roger Colten, Jago Cooper, John Crock, Gareth Davies, Susan deFrance, Wetherbee Dorshow, Geoff DuChemin, Neil Duncan, Nicholas Dunning, Janet Franklin, Perry L. Gnivecki, Sandrine Grouard, Corinne Hofman, Menno Hoogland, John Jones, George Kamenov, John Krigbaum, Erik Kiellmark, Miguel Lentino, Jim Mead, Deborah Pearsall, Lourdes Péres Iglesias, Nathalie Serrand, Peter Siegel, Till Sonnemann, Angel Soto-Centeno, David Steadman, and Brian Worthington. We also thank Tim Mighall for his editorial guidance and support as well as the many peer reviewers who contributed to the quality and success of the issue.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Michelle J. LeFebvre is a Postdoctoral Research Associate at the Florida Museum of Natural History, University of Florida. She is an anthropological and environmental archaeologist and her research focuses on historical ecological patterns of animal exploitation, use, manipulation, and consumption among indigenous and historic groups of the Caribbean and Florida. She is also focused on the mobilization and integration of zooarchaeological records within open biodiversity networks as a mechanism for identifying broad scale anthropogenic impacts on animal biodiversity and distribution.

Christina M. Giovas is an Assistant Professor of Archaeology at Simon Fraser University. Her research focuses on pre-historic fisheries, animal translocations, and the human paleoecology of island and coastal settings, particularly the Caribbean and Oceania. She is Associate Editor for the *Journal of Island and Coastal Archaeology* and serves as a Director on the Board of the International Association for Caribbean Archaeology.

Jason E. Laffoon is an Assistant Professor at Leiden University and Postdoctoral Researcher at the Free University Amsterdam. His research lies at the intersection of anthropological archaeology, biological anthropology, and archaeological science and focuses on the study of multi-scalar patterns of human and animal mobility, diet and subsistence, and provenance.

ORCID

Michelle J. LeFebvre  <http://orcid.org/0000-0002-1741-9997>

Christina M. Giovas  <http://orcid.org/0000-0002-4626-113X>

Jason E. Laffoon  <http://orcid.org/0000-0002-8821-805X>

References

- Antczak, K. A. 2018. "Cultivating Salt: Socio-Natural Assemblages on the Saltpans of the Venezuelan Islands, Seventeenth to Nineteenth Century." *Environmental Archaeology* 1: 56–68.
- Beets, C. J., S. R. Troelstra, P. M. Grootes, M. J. Nadeau, K. van der Borg, A. F. M. de Jong, C. L. Hofman, et al. 2006. "Climate and Pre-Columbian Settlement at Anse à la Gourde, Guadeloupe, Northeastern Caribbean." *Geoarchaeology* 21 (3): 271–280. DOI:10.1002/gea.20096.
- Bochaton, C., S. Grouard, R. Cornette, I. Ineich, A. Lenoble, A. Tresset, and S. Bailon. 2015. "Fossil and Subfossil Herpetofauna from Cadet 2 Cave (Marie-Galante, Guadeloupe Islands, F. W. I.): Evolution of an Insular Herpetofauna since the Late Pleistocene." *Comptes Rendus Palevol* 14: 101–110.
- Booden, M. A., R. G. A. M. Panhuysen, M. Hoogland, H. de Jong, H. GR Davies, and C. L. Hofman. 2008. "Tracing human mobility with ⁸⁷Sr/⁸⁶Sr at Anse à la Gourde, Guadeloupe." In *Crossing Disciplinary Boundaries and National Borders. New Methods and Techniques in the Study of Archaeological Materials From the Caribbean*, edited by C. L. Hofman, and A. L. van Gijn, 214–225. Tuscaloosa: University of Alabama Press.
- Boudadi-Maligne, M., S. Bailon, C. Bochaton, F. Casagrande, S. Grouard, N. Serrand, and A. Lenoble. 2016. "Evidence for Historical Human-induced Extinctions of Vertebrate Species on La Désirade (French West Indies)." *Quaternary Research* 85: 54–65.
- Carbone, V. A. 1980. "The Paleocology of the Caribbean Area." *The Florida Anthropologist* 33: 99–119.
- Chabanaud, P. 1946. "Faune du gisement précolombien d'Anse-Belleville : Poissons et Oiseaux." *Mémoires du Muséum* 22 (2): 19–126.
- Cooper, J. 2013. "The Climatic Context for Pre-Columbian Archaeology in the Caribbean." In *The Oxford Handbook of Caribbean Archaeology*, edited by W. F. Keegan, C. L. Hofman, and R. Rodríguez-Ramos, 47–58. Oxford: Oxford University Press.
- Deagan, K. D. 2004. "Reconsidering Taino Social Dynamics after Spanish Conquest: Gender and Class in Culture Contact Studies." *American Antiquity* 69: 597–626.
- deFrance, S. D. 1989. "Saladoid and Ostionoid Subsistence Adaptations: Zooarchaeological Data from a Coastal Occupation on Puerto Rico." In *Early Ceramic Population Lifeways and Adaptive Strategies in the Caribbean*, edited by P. E. Siegel, 57–78. Oxford: BAR International Series No. 506. British Archaeological Reports.
- deFrance, S. D. 2013. "Zooarchaeology in the Caribbean: Current Research and Future Prospects." In *The Oxford Handbook of Caribbean Archaeology*, edited by W. F. Keegan, C. L. Hofman, and R. Rodríguez-Ramos, 378–390. Oxford: Oxford University Press.
- Fitzpatrick, S. M., Q. Kaye, J. Feathers, J. A. Pavia, and K. M. Marsaglia. 2009. "Evidence for Inter-Island Transport of Heirlooms: Luminescence Dating and Petrographic Analysis of Ceramic Inhaling Bowls from Carriacou, West Indies." *Journal of Archaeological Science* 36 (3): 596–606.
- Friant, M. 1941. "Les mammifères précolombiens de la Martinique." *Bulletin de la Société Zoologique de France* 68(mars-mai): 300–302.
- García-Casco, A., S. Knippenberg, R. Rodríguez Ramos, G. E. Harlow, C. Hofman, J. Carlos Pomo, and I. F. Blanco-Quintero. 2013. "Pre-columbian Jadeite Artifacts from the Golden Rock site, St. Eustatius, Lesser Antilles, with Special Reference to Jadeite Artifacts from Elliot's, Antigua: Implications for Potential Source Regions and Long-Distance Exchange Networks in the Greater Caribbean." *Journal of Archaeological Science* 40 (8): 3153–3169.
- Giovas, C. M. 2018a. "The Beasts at Large – Perennial Questions and New Paradigms for Caribbean Translocation Research. Part II: Ethnophoresy in Cultural Context." *Environmental Archaeology*. DOI:10.1080/14614103.2018.1470211.
- Giovas, C. M. 2018b. "Continental Connections and Insular Distributions: Deer Bone Artifacts of the Precolumbian West Indies – A Review and Synthesis with New Records." *Latin American Antiquity* 29: 27–43.
- Giovas, C. M., G. D. Kamenov, S. M. Fitzpatrick, and J. Krigbaum. 2016. "Sr and Pb Isotopic Investigation of Mammal Introductions: Pre-Columbian Zoogeographic Records from the Lesser Antilles, West Indies." *Journal of Archaeological Science* 69: 39–53.
- Giovas, C. M., M. J. LeFebvre, and S. M. Fitzpatrick. 2012. "New Records for Prehistoric Introduction of Neotropical Mammals to the West Indies: Evidence from Carriacou, Lesser Antilles." *Journal of Biogeography* 39 (3): 476–487.
- Grouard, S. 2002. "Subsistance et mode de vie des premiers habitants de Guadeloupe (500 av. – 1500 ap. J.-C.)." *Préhistoires Méditerranéennes* 10–11: 191–213.
- Grouard, S. 2010. "Caribbean Archaeozoology." In *Current Advances in Latin-American Archaeozoology*, edited by G. Mengoni Goñalons, J. Arroyo-Cabrales, O. J. Polaco, and F. J. Aguilar, 133–151. Mexico: International Council for Archaeozoology and University of Buenos Aires.
- Hoffstetter, R. 1946. "Faune du Gisement Précolombien d'Anse-Belleville: Reptiles." *Mémoires du Muséum* 22 (1): 1–18.
- Hofman, C. L., A. Bright, A. Boomert, and S. Knippenberg. 2007. "Island Rhythms. The Web of Social Relationships and Interaction Networks in the pre-Columbian Lesser Antilles." *Latin American Antiquity* 18 (3): 243–268.
- Hofman, C. L., A. J. Bright, W. F. Keegan, and M. L. P. Hoogland. 2008. "Attractive Ideas, Desirable Goods: Examining the Late Ceramic Age Relationships between Greater and Lesser Antillean Societies." *Journal of Island and Coastal Archaeology* 3 (1): 17–34.
- Hofman, C. L., R. Rodríguez Ramos, and J. R. Pagán Jiménez. 2018. "The Neolithisation of the Northeastern Caribbean: Mobility and Social Interaction." In *The Archaeology of Caribbean and Circum-Caribbean Farmers 6000 BC – AD 1500*, edited by B. A. Reid, 71–97. New York: Routledge.
- Hoogland, M. L., C. L. Hofman, and R. G. A. M. Panhuysen. 2010. "Interisland dynamics: evidence for human mobility at the site of Anse à la Gourde, Guadeloupe." In *Island Shores, Distant Pasts: Archaeological and Biological Approaches to the Pre-Columbian Settlement of the Caribbean*, edited by S. M. Fitzpatrick, and A. H. Ross, 148–162. Gainesville: University Press of Florida.
- Keegan, W. F., and L. A. Carlson. 2008. *Talking Taino: Caribbean Natural History From a Native Perspective*. Tuscaloosa: The University of Alabama Press.
- Keegan, W. F., and C. L. Hofman. 2017. *The Caribbean Before Columbus*. New York: Oxford University Press.
- Kimura, B., M. J. LeFebvre, S. D. deFrance, H. J. Knodel, M. S. Turner, N. S. Fitzsimmons, S. M. Fitzpatrick, et al. 2016. "Origin of Pre-Columbian Guinea Pigs from Caribbean

- Archaeological Sites Revealed through Genetic Analysis.” *Journal of Archaeological Science: Reports* 5: 442–452.
- Kirch, P. V. 2008. “Hawaii as a Model System for Human Ecodynamics.” *American Anthropologist* 109 (1): 8–26.
- Laffoon, J. E. 2012. “Patterns of paleomobility in the ancient Antilles: an isotopic approach.” *PhD diss.*, Leiden University.
- Laffoon, J. E. 2013. “Paleomobility Research in Caribbean Contexts: New perspectives from Isotope Analysis.” In *The Oxford Handbook of Caribbean Archaeology*, edited by W. F. Keegan, C. L. Hofman, and R. Rodríguez-Ramos, 418–435. Oxford: Oxford University Press.
- Laffoon, J. E. 2016. “Human mobility and dietary patterns in precolonial Puerto Rico: integrating multiple isotope data.” In *Cuban Archaeology in the Caribbean*, edited by I. Roksandic, 147–167. Gainesville: University of Florida Press.
- Laffoon, J. E., G. R. Davies, M. L. P. Hoogland, and C. L. Hofman. 2012. “Spatial Variation of Biologically Available Strontium Isotopes ($^{87}\text{Sr}/^{86}\text{Sr}$) in an Archipelagic Setting: A Case Study from the Caribbean.” *Journal of Archaeological Science* 39 (7): 2371–2384.
- Laffoon, J. E., R. Espersen, and H. L. Mickleburgh. 2018. “The Life History of an Enslaved African: Multiple Isotope Evidence for Forced Childhood Migration from Africa to the Caribbean and Associated Dietary Change.” *Archaeometry* 60 (2): 350–365.
- Laffoon, J. E., and M. L. P. Hoogland. 2009. “An application of strontium isotope analysis to Caribbean contexts: promises and problems.” In *Proceedings of the 23rd Congress of the International Association for Caribbean Archaeology*, edited by S. Rebovich, 590–606. Antigua & Barbuda.
- Laffoon, J. E., and M. L. P. Hoogland. 2012. “Migration and mobility in the circum-Caribbean: integrating archaeology and isotopic analysis.” In *Population Dynamics in Prehistory and Early History: new Approaches Using Stable Isotopes and Genetics*, edited by J. Burger, E. Kaiser, and W. Schier, 337–353. Berlin: de Gruyter.
- Laffoon, J. E., E. Plomp, G. R. Davies, M. L. P. Hoogland, and C. L. Hofman. 2015. “The Movement and Exchange of Dogs in the Prehistoric Caribbean: An Isotopic Investigation.” *International Journal of Osteoarchaeology* 25 (4): 454–465.
- Laffoon, J. E., R. Rodríguez Ramos, L. A. Chanlatte Baik, Y. Narganes Storde, M. Lopez Rodríguez, G. R. Davies, and C. L. Hofman. 2014. “LongDistance Exchange in the Precolonial Circum-Caribbean: a Multi-Isotope Study of Animal Tooth Pendants from Puerto Rico.” *Journal of Anthropological Archaeology* 35: 220–233.
- Laffoon, J. E., T. F. Sonnemann, T. Shafie, C. L. Hofman, U. Brandes, and G. R. Davies. 2017. “Investigating Human Geographic Origins Using Dual-Isotope ($^{87}\text{Sr}/^{86}\text{Sr}$, $\delta^{18}\text{O}$) Assignment Approaches.” *PLOS One*. DOI:10.1371/journal.pone.0172562.
- Laffoon, J. E., R. Valcárcel Rojas, and C. L. Hofman. 2013. “Oxygen and Carbon Isotope Analysis of Human Dental Enamel from the Caribbean: Implications for Investigating Individual Origins.” *Archaeometry* 55 (4): 742–765.
- Lambrides, A. B., and M. I. Weisler. 2017. “Late Holocene Marshall Islands Archaeological Tuna Records Provide Proxy Evidence for ENSO Variability in the Western and Central Pacific Ocean.” *The Journal of Island and Coastal Archaeology*. DOI:10.1080/15564894.2017.1315350.
- Lane, C. S., S. P. Horn, and M. T. Kerr. 2014. “Beyond the Mayan Lowlands: Impacts of the Terminal Classic Drought in the Caribbean Antilles.” *Quaternary Science Reviews* 86: 89–98.
- LeFebvre, M. J. 2015. “Animals, Food, and Social Life among the Pre-Columbian Taíno of En Bas Saline, Hispaniola.” *PhD diss.*, University of Florida.
- LeFebvre, M. J., and S. D. deFrance. 2014. “Guinea pigs in the Pre-Columbian West Indies.” *Journal of Island and Coastal Archaeology* 9: 16–44.
- LeFebvre, M. J., and S. D. deFrance. 2018. “Animal Management and Domestication in the Realm of Ceramic Age Farming.” In *The Archaeology of Caribbean and Circum-Caribbean Farmers 6000 BC-AD 1500*, edited by B. A. Reid, 149–170. New York: Routledge Press.
- Lord, E., C. Collins, S. deFrance, M. J. LeFebvre, and E. Matisoo-Smith. 2018. “Complete Mitogenomes of Ancient Caribbean Guinea Pigs (*Cavia porcellus*.)” *Journal of Archaeological Science: Reports* 17: 678–688.
- McGlade, J. 1995. “Archaeology and the Ecodynamics of Human-Modified Landscapes.” *Antiquity* 65: 113–132.
- Mol, A. A. A. 2013. “Studying Pre-Columbian Interaction Networks: Mobility and Exchange.” In *The Oxford Handbook of Caribbean Archaeology*, edited by W. F. Keegan, C. L. Hofman, and R. Rodríguez-Ramos, 329–346. Oxford: Oxford University Press.
- Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. da Fonseca, and J. Kent. 2000. “Biodiversity Hotspots for Conservation Priorities.” *Nature* 403: 853–858.
- Newsom, L.A. 1988. Archaeobotanical Analysis of Three Features From a Prehistoric Habitation Site. In *Puerto Rico: El Fresal, Cuyón, Aibonito*, edited by M.J. Melendez, C1-13. U.S. Department of Agriculture Programa de Finca Familiares, Título VI.
- Newsom, L. A., and E. S. Wing. 2004. *On Land and Sea: Native American Uses of Biological Resources in the West Indies*. Tuscaloosa: The University of Alabama Press.
- Otaola, C., S. Wolverson, M. A. Giardina, and G. Neme. 2015. “Geographic Scale and Zooarchaeological Analysis of Late Holocene Adaptations in Western Argentina.” *Journal of Archaeological Science* 55: 6–25.
- Pagán Jiménez, J. R. 2013. “Human-Plant Dynamics in the Precolonial Antilles.” In *The Oxford Handbook of Caribbean Archaeology*, edited by W. F. Keegan, C. L. Hofman, and R. Rodríguez-Ramos, 391–406. Oxford: Oxford University Press.
- Pagán Jiménez, J. R., R. Rodríguez Ramos, B. A. Reid, M. van del Bel, and C. L. Hofman. 2015. “Early Dispersals of Maize and other Food Plants into the Southern Caribbean and Northeastern South America.” *Quaternary Science Reviews* 123: 231–246.
- Pearsall, D. M. 1985. “Analysis of Soil Phytoliths and Botanical Macroremains from El Bronce Archaeological Site, Ponce, Puerto Rico. Appendix in Archaeological Data Recovery at El Bronce.” In *Puerto Rico, Final Report Phase 2*. Jacksonville: United States Army Corps of Engineers.
- Pearsall, D. M. 1989. “Plant Utilization at the Krum Bay Site, St. Thomas, U.S.V.I. Appendix C in Pre-ceramic Procurement Patterns at Krum Bay, Virgin Islands (E.R. Lundberg).” *Ph.D. diss.*, University of Illinois, Urbana.
- Perdikaris, S., S. Bain, S. Grouard, K. Baker, E. Gonzalez, A. Rus Hoelzel, H. Miller, et al. 2018. “From Icon of Empire to National Emblem: New Evidence for the Fallow Deer of Barbuda.” *Environmental Archaeology* 23: 47–55.
- Peréz Iglesias, L., and R. Valcárcel Rojas. 2014. “Restos de Cerdo en los Contextos Arqueológicos de El Chorro de Maíta, Holguín, Cuba.” *Ethnobiología* 12 (2): 39–49.

- Pestle, W. J. 2013. "Fishing Down a Prehistoric Caribbean Marine Food Web: Isotopic Evidence from Punta Candeleró, Puerto Rico." *The Journal of Island and Coastal Archaeology* 8 (2): 228–254.
- Rainey, F. G. 1940. *Porto Rican Archaeology. Scientific Survey of Porto Rico and the Virgin Islands. Vol. XVII-Part I*. New York: New York Academy of Sciences.
- Reid, B. A., ed. 2018. *The Archaeology of Caribbean and Circum-Caribbean Farmers 6000 BC – AD 1500*. New York: Routledge.
- Reitz, E. J., and B. G. McEwan. 1995. "Animals, Environment, and the Spanish Diet at Puerto Real." In *Puerto Real: The Archaeology of a Sixteenth-Century Spanish Town in Hispaniola*, edited by K. D. Deagan, 287–334. Gainesville: University Press of Florida.
- Reitz, E. J., and M. Shackley. 2012. *Environmental Archaeology*. New York: Springer.
- Rivera Collazo, I. C. 2011. "Between Land and Sea in Puerto Rico: Climates, Coastal Landscapes and Human Occupations in the Mid-Holocene Caribbean." *PhD diss.*, University College London.
- Rodríguez Ramos, R. 2005. "The Crab-Shell Dichotomy Revisited: The Lithics Speak Out." In *Ancient Borinquen: Archaeology and Ethnohistory of Native Puerto Rico*, edited by P. E. Siegel, 1–53. Tuscaloosa: University of Alabama Press.
- Rodríguez Ramos, R. 2010. *Rethinking Puerto Rican Precolonial History*. Tuscaloosa: University of Alabama Press.
- Rodríguez Ramos, R., and J. R. Pagán Jiménez. 2006. "Interacciones Multivectoriales en El Circum-Caribe Precolonial: Un Vistaza desde Las Antillas." *Caribbean Studies* 34 (2): 99–139.
- Rouse, I. 1992. *The Tainos: Rise and Decline of the People Who Greeted Columbus*. New Haven: Yale University Press.
- Schroeder, H., J. B. Haviser, and T. D. Price. 2014. "The Zoutsteeg Three: Three New Cases of African Types of Dental Modification from Saint Martin, Dutch Caribbean." *International Journal of Osteoarchaeology* 24 (6): 688–696.
- Schroeder, H., T. C. O'Connell, J. A. Evans, K. A. Shuler, and R. E. Hedges. 2009. "Trans-Atlantic Slavery: Isotopic Evidence for Forced Migration to Barbados." *American Journal of Physical Anthropology* 139 (4): 547–557.
- Schroeder, H., M. Sikora, S. Gopalakrishnan, L. M. Cassidy, P. Maisano Delser, M. Sandoval Velasco, J. G. Schraiber, et al. 2018. "Origins and Genetic Legacies of the Caribbean Taino." *Proceedings of the National Academy of Science* 115 (10): 2341–2346.
- Siegel, P. E., J. G. Jones, D. M. Pearsall, N. P. Dunning, P. Farrell, N. A. Duncan, J. H. Curtis, et al. 2015. "Paleoenvironmental Evidence for First Human Colonization of the Eastern Caribbean." *Quaternary Science Reviews* 129: 275–295.
- Siegel, P. E., J. G. Jones, D. M. Pearsall, N. P. Dunning, P. Farrell, N. A. Duncan, J. H. Curtis, et al. 2018. "Humanizing the Landscapes of the Lesser Antilles during the Archaic Age." In *The Archaeology of Caribbean and Circum-Caribbean Farmers 6000 BC – AD 1500*, edited by B. A. Reid, 55–70. New York: Routledge.
- Steadman, D. W., G. K. Pregill, and S. L. Olson. 1984. "Fossil Vertebrates from Antigua, Lesser Antilles: Evidence for Late Holocene Human-Caused." *Proceedings of the National Academy of Science* 81: 4448–4451.
- Steadman, D. W., H. M. Singleton, K. L. Delancy, N. A. Albury, J. A. Soto-Centeno, H. Gough, N. Duncan, et al. 2017. "Late Holocene Historical Ecology: The Timing of Vertebrate Extirpation on Crooked Island, The Bahamas." *Journal of Island and Coastal Archaeology* 12 (4): 572–584. DOI:10.1080/15564894.2017.1305469.
- Steadman, D. W., and A. V. Stokes. 2002. "Changing Exploitation of Terrestrial Vertebrates during the Past 3000 Years on Tobago, West Indies." *Human Ecology* 30 (3): 339–367.
- Stouvenot, C., S. Grouard, S. Bailon, D. Bonnissent, A. Lenoble, N. Serrand, and V. Sierpe. 2014. "L'abri sous roche Cadet 3 (Marie-Galante): un gisement à accumulations de faune et à ves-tiges archéologiques." In *Archéologie Caraïbe*, edited by B. Bernard and C. Losier, 77–102. Leiden: Sidestone Press.
- Valcárcel Rojas, R., D. A. Weston, H. L. Mickleburgh, J. E. Laffoon, and A. van Duijvenbode. 2011. "El Chorro de Maíta. A diverse approach to a context of diversity." In *Communities in Contact: Essays in Archaeology, Ethnohistory & Ethnography of the Amerindian Circum-Caribbean*, edited by C. L. Hofman, and A. van Duijvenbode, 225–252. Leiden: Sidestone Press.
- Wallman, D., and S. Grouard. 2017. "Enslaved Laborer and Sharecropper Fishing Practices in 18th-19th Century Martinique: A Zooarchaeological and Ethnozoohistorical Study." *Journal of Ethnobiology* 37 (3): 398–420.
- Wallman, D., E. C. Wells, and I. C. Rivera-Collazo. 2018. "The Environmental Legacies of Colonialism in the Northern Neotropics: Introduction to the Special Issue." *Environmental Archaeology* 1: 1–3.
- Wilson, S. M. *The Archaeology of the Caribbean*. Cambridge: Cambridge University Press.
- Wing, E. S. 1961. "Animal Remains Excavated at the Spanish Site of Nueva Cadiz on Cubagua Island, Venezuela." *Nieuwe West-Indische Gids/New West Indian Guide* 41: 162–165.
- Wing, E. S. 1962. "Succession of Mammalian Faunas on Trinidad, West Indies." *PhD diss.*, University of Florida, Gainesville.
- Wing, E. S., C. E. Ray, and C. A. Hofman, Jr. 1968. "Vertebrate Remains from Indian Sites on Antigua, West Indies." *Caribbean Journal of Science* 8 (3–4): 13–32.
- Wing, E. S., and E. J. Reitz. 1982. "Prehistoric Fishing Communities of the Caribbean." *Journal of New World Archaeology* 5 (2): 13–32.
- Wing, E. S., and S. J. Scudder. 1980. "Use of Animals by the Prehistoric Inhabitants of St. Kitts, West Indies." *Proceedings of the Eighth International Congress for the Study of Pre-Columbian Cultures of the Lesser Antilles*. Arizona State University: Anthropological Research Papers No. 22: 237–145.