

References

Aktuell

AARTSEN 2019

Marja J. Aartsen et al., *Advantaged socioeconomic conditions in childhood are associated with higher cognitive functioning but stronger cognitive decline in older age*. [PNAS 116 \(2019\), 5478–5486](#).

Marja J. Aartsen, Boris Cheval, Stefan Sieber, Bernadette W. Van der Linden, Rainer Gabriel, Delphine S. Courvoisier, Idris Guessous, Claudine Burton-Jeangros, David Blane, Andreas Ihle, Matthias Kliegel & Stéphane Cullati

Cognitive aging is characterized by large heterogeneity, which may be due to variations in childhood socioeconomic conditions (CSC). Although there is substantial evidence for an effect of CSC on levels of cognitive functioning at older age, results on associations with cognitive decline are mixed. We examined by means of an accelerated longitudinal design the association between CSC and cognitive trajectories from 50 to 96 years. Cognition included two functions generally found to decline with aging: delayed recall and verbal fluency. Data are from six waves of the Survey of Health, Aging, and Retirement in Europe (SHARE), conducted between 2004 and 2015 (n = 24,066 at baseline; 56 % female, age 50+). We found a consistent CSC pattern in levels of cognitive functioning in later life. Older people with disadvantaged CSC had lower levels of cognitive functioning than those with more advantaged CSC. We also find that decline is almost 1.6 times faster in the most advantaged group compared with the most disadvantaged group. The faster decline for people with more advantaged CSC becomes less pronounced when we additionally control for adulthood socioeconomic conditions and current levels of physical activity, depressive symptoms, and partner status. Our findings are in line with the latency, pathway, and cumulative model and lend support to theories of cognitive reserve, stating that neuronal loss can no longer be repaired in people with more cognitive reserve once the underlying pathology is substantial and speed of decline is accelerated.

Keywords: socioeconomic position | cognition | life course | life span | aging

Significance: There is increasing evidence that socioeconomic conditions early in life have an impact on cognitive functioning in later life. Based on the large longitudinal sample from SHARE we find a clear pattern in cognitive functioning in old age, related to childhood socioeconomic conditions: Those from more affluent households show higher levels of fluid intelligence in old age and experience stronger decline over time in executive functions. The latter phenomenon is not often documented. Although modifications in cognitive functioning with aging are inevitable, life course socioeconomic circumstances impact the timing of this process. We conclude that the etiology of cognitive aging is the result of multiple social processes, defined by the socioeconomic conditions in childhood and all along the life course.

ABRAHMS 2019

Briana Abrahms et al., *Memory and resource tracking drive blue whale migrations*. [PNAS 116 \(2019\), 5582–5587](#).

[pnas116-05582-Supplement.pdf](#)

Briana Abrahms, Elliott L. Hazen, Ellen O. Aikens, Matthew S. Savoca, Jeremy A. Goldbogen, Steven J. Bograd, Michael G. Jacox, Ladd M. Irvine, Daniel M. Palacios & Bruce R. Mate

In terrestrial systems, the green wave hypothesis posits that migrating animals can enhance foraging opportunities by tracking phenological variation in high-quality forage across space (i.e., “resource waves”). To track resource waves, animals may rely on proximate cues and/or memory of long-term average phenologies. Although there is growing evidence of resource tracking in terrestrial migrants, such drivers remain unevaluated in migratory marine megafauna. Here we present a test of the green wave hypothesis in a marine system. We compare 10 years of blue whale movement data with the timing of the spring phytoplankton bloom resulting in increased prey availability in the California Current Ecosystem, allowing us to investigate resource tracking both contemporaneously (response to proximate cues) and based on climatological conditions (memory) during migrations. Blue whales closely tracked the long-term average phenology of the spring bloom, but did not track contemporaneous green-up. In addition, blue whale foraging locations were characterized by low long-term habitat variability and high long-term productivity compared with contemporaneous measurements. Results indicate that memory of long-term average conditions may have a previously underappreciated role in driving migratory movements of long-lived species in marine systems, and suggest that these animals may struggle to respond to rapid deviations from historical mean environmental conditions. Results further highlight that an ecological theory of migration is conserved across marine and terrestrial systems. Understanding the drivers of animal migration is critical for assessing how environmental changes will affect highly mobile fauna at a global scale.

Keywords: marine megafauna | migration | movement ecology | resource wave | spatial memory

Significance: The causes and consequences of animal migration have received substantial research attention, yet the mechanisms underlying this global phenomenon remain largely untested in marine systems. By combining 10 years of satellite tracking data on blue whales with simultaneous remotely-sensed oceanographic measurements in the North Pacific, we demonstrate that both long-term memory and resource tracking play key roles in the long-distance migrations of marine megafauna. These findings have important implications for long-lived species across systems and taxa, as long-range migrants conditioned by historical environmental processes may struggle in response to rapid environmental change. Finally, our study reveals that ecological theory of animal migrations is conserved across marine and terrestrial systems.

ARCHIVE 2019

From the archive, How Nature reported Australian flooding in 1919.
[nature 567 \(2019\), 319.](#)

At Macedon 8 in. were registered in twenty-four hours, and thirteen inches of rain in twenty-four hours has practically drowned the township of East Bellingren.

EDITORIAL 2019

Significant debate. [nature 567 \(2019\), 283.](#)

Looking beyond statistical significance would make science harder, but might help to avoid false positives, overhyped claims and overlooked effects.

Fans of *The Hitchhiker’s Guide to the Galaxy* know that the answer to life, the Universe and everything is 42. The joke, of course, is that truth cannot be revealed by a single number.

If researchers do discard statistical significance, what should they do instead? They can start by educating themselves about statistical misconceptions. Most

important will be the courage to consider uncertainty from multiple angles in every study. Logic, background knowledge and experimental design should be considered alongside P values and similar metrics to reach a conclusion and decide on its certainty.

When working out which methods to use, researchers should also focus as much as possible on actual problems. People who will duel to the death over abstract theories on the best way to use statistics often agree on results when they are presented with concrete scenarios.

FAGAN 2019

William F. Fagan, *Migrating whales depend on memory to exploit reliable resources*. [PNAS 116 \(2019\), 5217–5219](#).

As advantageous as memory can be, memory can be downright harmful if it repeatedly fails to represent the current reality. Indeed, decreases in landscape predictability greatly reduce the benefits of memory as a navigation mechanism. It is an intriguing issue of scale dependence that variability can drive the emergence of migratory movements, but predictability is essential to their long-term maintenance.

How blue whales will respond to changing conditions is unknown. Social exchange of information could play a role in shaping those responses. Such information could be passed vertically via spatial learning in persistent cow–calf pairs or via vocalizations. For example, humpback whales, whose well-known “song” vocalizations appear to play a role in sexual selection, also produce a diverse variety of nonsong sounds, some of which may be used in intergroup communication to convey location.

HSIEH 2019

I-Yun Lisa Hsieh, Menghsuan Sam Pan, Yet-Ming Chiang & William H. Green, *Learning only buys you so much, Practical limits on battery price reduction*. [Applied Energy 239 \(2019\), 218–224](#).

Highlights:

- Low battery prices would facilitate transition to electro mobility.
- Essential materials costs set lower limits on electric vehicle battery prices.
- Lithium-ion NMC battery is unlikely to reach the \$ 100/kWh price target.
- New battery chemistry is required to lower the price floor imposed by materials.

Wide deployment of electric vehicles (EVs) would greatly facilitate global decarbonization, but achieving the emission targets depends on future battery prices. Conventional learning curves for manufacturing costs, used in many battery projections, unrealistically predict battery prices will fall below \$ 100/kWh by 2030, pushing EVs to hit price parity with internal combustion engine vehicles (ICEVs) in the absence of incentives. However, in reality, essential materials costs set practical lower bounds on battery prices. Our 2-stage learning curve model projects the active material costs and NMC-based Lithium-ion battery pack price with mineral and material costs as the respective price floors. The improved model predicts nickel-manganesecobalt (NMC) battery prices will fall only to about \$ 124/kWh by 2030 – much cheaper than today, but still too expensive to truly compete with ICEVs, due primarily to the high prices of cobalt, nickel, and lithium. Our results suggest that stabilizing raw materials prices and/or stimulating R&D activities on alternative battery chemistries will be important to achieve environmentally sustainable EV-based ground transportation at an attractive price.

Keywords: Energy science | Battery technology | Energy storage | Energy economics | Electro mobility

KASPARI 2019

Michael Kaspari, *In a globally warming world, insects act locally to manipulate their own microclimate*. [PNAS 116 \(2019\), 5220–5222](#).

KOSKELA 2019

Juha Koskela, Antti Rautiainen & Pertti Järventausta, *Using electrical energy storage in residential buildings, Sizing of battery and photovoltaic panels based on electricity cost optimization*. [Applied Energy 239 \(2019\), 1175–1189](#).

Highlights:

- The basic novel concepts used for the sizing of the solar panel were introduced.
- Use of storage could increase the profitability of photovoltaic power generation.
- Different incentives could be combined in the control of electrical energy storage.
- The size of the solar panel could increase when the community model was applied.

The popularity of small-scale residential energy production using photovoltaic power generation is predicted to increase. Self-production of electricity for self-consumption has become profitable mainly because of high-distribution costs and taxes imposed by the service providers on commercially produced electricity or because of the subsidies which reduce installation costs. Electrical energy storage can be used to increase the self-consumption potential of photovoltaic power. Additionally, electrical energy storage can lead to other benefits such as demand response or avoiding high load peaks. In this study, the profitability and sizing of a photovoltaic system with an associated electrical energy storage are analyzed from an economic perspective. The novel theory of sizing for profitability is presented and demonstrated using case studies of an apartment building and detached houses in Finland. To maximize the benefits, several alternative models for electricity metering and pricing are used and compared. The results demonstrated that the optimal size of the photovoltaic system could be increased by using electrical energy storage and suitable electricity pricing. This could lead to an increasing amount of photovoltaic production in the residential sector. Additionally, it is possible that when all the incentives are taken into account, electrical energy storage in combination with photovoltaic power generation would be more profitable than photovoltaic power generation alone. Photovoltaic power generation also increased the profitability of electrical energy storage, which could mean that the implementation of electrical energy storage in the residential sector could likewise increase.

Keywords: Cost optimization | Energy community model | Energy storage | Photovoltaic | Residential building | Self-consumption

WILLIAMS 2019

Austin M. Williams, Daniel J. Phaneuf, Meredith A. Barrett & Jason G. Su, *Short-term impact of PM_{2.5} on contemporaneous asthma medication use, Behavior and the value of pollution reductions*. [PNAS 116 \(2019\), 5246–5253](#).

[pnas116-05246-Supplement.pdf](#)

Asthma ranks among the most costly of chronic diseases, accounting for over \$50 billion annually in direct medical expenditures in the United States. At the same time, evidence has accumulated that fine particulate matter pollution can exacerbate asthma symptoms and generate substantial economic costs. To measure these costs, we use a unique nationwide panel dataset tracking asthmatic individuals' use of rescue medication and their exposure to PM_{2.5} (particulate matter with

an aerodynamic diameter of $<2.5 \mu\text{m}$) concentration between 2012 and 2017, to estimate the causal relationship between pollution and inhaler use. Our sample consists of individuals using an asthma digital health platform, which relies on a wireless sensor to track the place and time of inhaler use events, as well as regular nonevent location and time indicators. These data provide an accurate measurement of inhaler use and allow spatially and temporally resolute assignment of pollution exposure. Using a high-frequency research design and individual fixed effects, we find that a $1 \mu\text{g}/\text{m}^3$ (12%) increase in weekly exposure to $\text{PM}_{2.5}$ increases weekly inhaler use by 0.82%. We also show that there is seasonal, regional, and income-based heterogeneity in this response. Using our response prediction, and an estimate from the literature on the willingness to pay to avoid asthma symptoms, we show that a nationwide $1 \mu\text{g}/\text{m}^3$ reduction in particulate matter concentration would generate nearly \$350 million annually in economic benefits.

Keywords: particulate matter | asthma | rescue inhaler | economic value

Bibel

FAUST 2018

Avraham Faust, *Pigs in Space (and Time), Pork Consumption and Identity Negotiations in the Late Bronze and Iron Ages of Ancient Israel*. [Near Eastern Archaeology](#) **81** (2018), 276–299.

Pork consumption, or to be more precise, its avoidance, became a major issue in the study of ancient Israel in the 1980s. Subsequently, it became closely associated not only with the debates over Israel's emergence in Canaan and ethnic interaction during the Iron Age I, but also regarding the transformations of Philistine society, as well as with general debates on relations between pork consumption and taboos, ecology, and environment. Relying on the vast database that accumulated, it is my aim here to reexamine the distribution of pork-consuming communities during the Late Bronze and Iron Ages in order to see if clear and meaningful patterns can be identified. Subsequently, the paper will study the emerging patterns, and examine how they should be interpreted, and whether patterns of consumption and avoidance can, or cannot, be associated with the different groups that inhabited the region at the time, and if the explanations to these patterns should be attributed to culture or to ecology and economy.

FAUST 2019

Avraham Faust, *Israelite Temples, Where Was Israelite Cult Not Practiced, and Why*. [Religions](#) **10** (2019), 106, 1–26.

Most scholars in the late 20th and early 21st century believed that cultic activity in the kingdoms of Israel and Judah was practiced in various temples that were scattered throughout the kingdoms. Still, a detailed study of the archaeological evidence on Israelite cult reveals that Israelite cultic buildings were extremely rare, both in absolute terms and when compared to other ancient Near Eastern societies, suggesting that cultic activity in temples was the exception rather than the norm and that typical Israelite cult was practiced in the household and in other, non-temple settings. Hence, the evidence suggests that rather than viewing temples, like the one in Arad, as exemplifying typical cultic activity, they should be viewed as exceptions that require a special explanation. The first part of the article develops and updates the suggestion, first raised about ten years ago, that Israelite temples were indeed extremely rare. Given the ancient Near Eastern context, however, such practices seem to be exceptional, and the second part of the article will therefore explain why such a unique pattern was not identified in the

past, and will suggest a possible explanation as to how was such an outstanding practice developed and adopted.

Keywords: Israelite religion | temples | ancient Israel | cultic buildings | shrines | sanctuaries | biblical archaeology | egalitarian ethos

Biologie

FAY 2019

Justin C. Fay et al., *A polyploid admixed origin of beer yeasts derived from European and Asian wine populations*. *PLoS Biology* **17** (2019), e3000147. DOI:10.1371/journal.pbio.3000147.

Justin C. Fay, Ping Liu, Giang T. Ong, Maitreya J. Dunham, Gareth A. Cromie, Eric W. Jeffery, Catherine L. Ludlow & Aimée M. Dudley

The budding yeast *Saccharomyces cerevisiae* has long been used to make beer. Yeast strains used to make ales are known to differ genetically and phenotypically from strains used to make wine and from strains isolated from nature, such as oak isolates. Beer strains are also known to be polyploid, having more than two copies of their genome per cell. To determine the ancestry of beer strains, we compared the genomes of beer strains with the genomes of a large collection of strains isolated from diverse sources and geographic locations. We found ale, baking, and the *S. cerevisiae* portion of lager strains to have ancestry that is a mixture of European grape wine strains and Asian rice wine strains and that they carry novel alleles from an extinct or uncharacterized population. The mixed ancestry of beer strains has been maintained in a polyploid state, which provided a means of strain diversification through gain or loss of genetic variation within a strain but also a means of maintaining brewing characteristics by reducing or eliminating genetic exchange with other strains. Our results show that ale strains emerged from a mixture of previously used fermentation technology.

Abstract Strains of *Saccharomyces cerevisiae* used to make beer, bread, and wine are genetically and phenotypically distinct from wild populations associated with trees. The origins of these domesticated populations are not always clear; human-associated migration and admixture with wild populations have had a strong impact on *S. cerevisiae* population structure. We examined the population genetic history of beer strains and found that ale strains and the *S. cerevisiae* portion of allotetraploid lager strains were derived from admixture between populations closely related to European grape wine strains and Asian rice wine strains. Similar to both lager and baking strains, ale strains are polyploid, providing them with a passive means of remaining isolated from other populations and providing us with a living relic of their ancestral hybridization. To reconstruct their polyploid origin, we phased the genomes of two ale strains and found ale haplotypes to both be recombinants between European and Asian alleles and to also contain novel alleles derived from extinct or as yet uncharacterized populations. We conclude that modern beer strains are the product of a historical melting pot of fermentation technology.

Energie

BLOESS 2019

Andreas Bloess, *Impacts of heat sector transformation on Germany's power system through increased use of power-to-heat*. *Applied Energy* **239** (2019), 560–580.

Highlights:

- Extension of European power sector model to also include the German heat demand sector.
- Detailed modelling of combined heat and power (CHP) and power-to-heat technologies.
- Findings: Up to additional 260 TWh of electricity demand through power-to-heat.
- Additional power is covered by capacity expansions of wind, gas and imports.
- Power storage capacity development shifts over from battery to power-to-gas technology.

The heating sector accounts for a major part of Germanys energy consumption and carbon emissions. Both, renewable energy and power-to-heat, could help decarbonizing it. To analyse the impacts of power-to-heat and heat storage on power system development, a dynamic long-term power sector investment and dispatch model for Europe is extended to also include German individual and district heating. Findings show that power-to-heat causes a substantial rise in electricity demand, even if heat energy demand decreases strongly. Power generation from wind and natural gas accordingly increase. Power-to-gas capacity increasingly substitutes battery storage. Combined heat and power does not play a role in future scenarios.

Keywords: Power sector modelling | Sector coupling | Power-to-heat | C61 | D61 | Q42

MORSTYN 2019

Thomas Morstyn, Martin Chilcott & Malcolm D. McCulloch, *Gravity energy storage with suspended weights for abandoned mine shafts*. [Applied Energy](#) **239** (2019), 201–206.

Highlights:

- Suspended weights in disused mine shafts offers a new energy storage technology.
- Requires minimal land-use and can make use of existing excavations.
- Analysis is presented for sizing the weight to maximize the storage capacity.
- Decoupled power and energy capacity makes it suitable for high power applications.
- Former mines in the United Kingdom Midlands could provide 804 MWh of storage.

This paper investigates the potential of using gravity energy storage with suspended weights as a new technology for redeveloping abandoned deep mine shafts. The technology has relatively low energy density, but has advantages including a power capacity decoupled from its energy capacity, no cycle-limit and the potential to be combined with compressed air energy storage. It is currently being trialled in the United Kingdom, targeting abandoned coal mines. The paper presents analysis for sizing the suspended weight to maximize the energy storage capacity, given a mine shaft’s physical dimensions. In addition, it is shown that the power capacity of the system’s motor and power electronics determine the maximum ramp-rate, and therefore the range of power system services that can be provided. A case study is presented, estimating the total energy storage capacity which could be obtained by converting abandoned mines in the United Kingdom Midlands, using geographic information system data from the United Kingdom Government Coal Authority Abandoned Mine Catalogue.

Keywords: Energy storage | Gravity | GIS | Mine | Power system | Suspended weight

Keramik

HACIOSMANOĞLU 2018

S. Haciosmanoğlu, M. Kibaroglu, G. Sunal, E. Kozal & P. Gutsuz, *Geochemical And Petrographic Analysis of Late Bronze Age Cypriot Ceramics (White Slip I and II and Monochrome) From Tell Atchana/Alalakh (Hatay) in the Amuq Valley*. *Archaeometry* **60** (2018), 471–488.

White Slip ware, both White Slip I and II, and Monochrome ware are Middle to Late Bronze Age Cypriot pottery types found across a large area of the Eastern Mediterranean region. A vast quantity of these wares has also been uncovered in Tell Atchana/ancient Alalakh in Hatay in southern Anatolia. We analysed a total of 56 White Slip (n =36) and Monochrome potsherds (n =20) from Tell Atchana using XRF, ICP–MS and petrographic thin-section methods. The main aim of the study was to explore the compositional characteristics of the wares and to determine whether they are local imitations of the Cypriot White Slip and Monochrome wares or represent Cypriot exports to this region. The analytical results proved that White Slip I and II were produced from raw clay of mafic and ultramafic source rocks exposed in the Troodos Massif, available in the Limassol area of southern Cyprus and traded to Tell Atchana. Examples of Monochrome ware excavated in Tell Atchana were also imported to the region, most probably from east/north-east Cyprus. These results demonstrate a close trading connection between Tell Atchana/Alalakh and southern Cyprus during the Middle to Late Bronze Age.

Keywords: Eastern Mediterranean | Tell Atchana | Amuq Valley | Cyprus | Late Bronze Age | Chemical Analysis | Petrography

Klima

RYAN 2019

J. C. Ryan, L. C. Smith, D. van As, S. W. Cooley, M. G. Cooper, L. H. Pitcher & A. Hubbard, *Greenland Ice Sheet surface melt amplified by snowline migration and bare ice exposure*. *Science Advances* **5** (2019), eaav3738. DOI:10.1126/sciadv.aav3738.

SciAdv05-eaav3738-Supplement.pdf

Greenland Ice Sheet mass loss has recently increased because of enhanced surface melt and runoff. Since melt is critically modulated by surface albedo, understanding the processes and feedbacks that alter albedo is a prerequisite for accurately forecasting mass loss. Using satellite imagery, we demonstrate the importance of Greenland's seasonally fluctuating snowline, which reduces ice sheet albedo and enhances melt by exposing dark bare ice. From 2001 to 2017, this process drove 53 % of net shortwave radiation variability in the ablation zone and amplified ice sheet melt five times more than hydrological and biological processes that darken bare ice itself. In a warmer climate, snowline fluctuations will exert an even greater control on melt due to flatter ice sheet topography at higher elevations. Current climate models, however, inaccurately predict snowline elevations during high melt years, portending an unforeseen uncertainty in forecasts of Greenland's runoff contribution to global sea level rise.

WAHL 2019

Eugene R. Wahl, Eduardo Zorita, Valerie Trouet & Alan H. Taylor, *Jet stream dynamics, hydroclimate, and fire in California from 1600 CE to present*. [PNAS 116 \(2019\), 5393–5398](#).

[pnas116-05393-Supplement.pdf](#)

Moisture delivery in California is largely regulated by the strength and position of the North Pacific jet stream (NPJ), winter high-altitude winds that influence regional hydroclimate and forest fire during the following warm season. We use climate model simulations and paleoclimate data to reconstruct winter NPJ characteristics back to 1571 CE to identify the influence of NPJ behavior on moisture and forest fire extremes in California before and during the more recent period of fire suppression. Maximum zonal NPJ velocity is lower and northward shifted and has a larger latitudinal spread during presuppression dry and high-fire extremes. Conversely, maximum zonal NPJ is higher and southward shifted, with narrower latitudinal spread during wet and low-fire extremes. These NPJ, precipitation, and fire associations hold across pre-20th-century socioecological fire regimes, including Native American burning, postcontact disruption and native population decline, and intensification of forest use during the later 19th century. Precipitation extremes and NPJ behavior remain linked in the 20th and 21st centuries, but fire extremes become uncoupled due to fire suppression after 1900. Simulated future conditions in California include more wet-season moisture as rain (and less as snow), a longer fire season, and higher temperatures, leading to drier fire-season conditions independent of 21st-century precipitation changes. Assuming continuation of current fire management practices, thermodynamic warming is expected to override the dynamical influence of the NPJ on climate–fire relationships controlling fire extremes in California. Recent widespread fires in California in association with wet extremes may be early evidence of this change.

Keywords: jet stream | precipitation | fire | California | paleoclimatology

Significance: North Pacific jet stream (NPJ) behavior strongly affects coolseason moisture delivery in California and is an important predictor of summer fire conditions. Reconstructions of the NPJ before modern fire suppression began in the early 20th century identify the relationships between NPJ characteristics and precipitation and fire extremes. After fire suppression, the relationship between the NPJ and precipitation extremes is unchanged, but the NPJ–fire extremes relationship breaks down. Simulations with high CO₂ forcing show higher temperatures, reduced snowpack, and drier summers by 2070 to 2100 whether overall precipitation is enhanced or reduced, thereby overriding historical dynamic NPJ precursor conditions and increasing fire potential due to thermodynamic warming. Recent California fires during wet extremes may be early evidence of this change.

WHITE 2019

A. J. White, Lora R. Stevens, Varenka Lorenzi, Samuel E. Munoz, Sissel Schroeder, Angelica Cao & Taylor Bogdanovich, *Fecal stanols show simultaneous flooding and seasonal precipitation change correlate with Cahokia’s population decline*. [PNAS 116 \(2019\), 5461–5466](#).

[pnas116-05461-Supplement.pdf](#)

A number of competing hypotheses, including hydroclimatic variations, environmental degradation and disturbance, and sociopolitical disintegration, have emerged to explain the dissolution of Cahokia, the largest prehistoric population center in the United States. Because it is likely that Cahokia’s decline was precipitated by multiple factors, some environmental and some societal, a robust understanding of this phenomenon will require multiple lines of evidence along with a refined chronology. Here, we use fecal stanol data from Horseshoe Lake,

Illinois, as a population proxy for Cahokia and the broader Horseshoe Lakewatershed. We directly compare the fecal stanol data with oxygen stable-isotope and paleoenvironmental data from the same sediment cores to evaluate the role of flooding, drought, and environmental degradation in Cahokia's demographic decline and sociopolitical reorganization. We find that Mississippi River flooding and warm season droughts detrimental to agriculture occurred circa (ca.) 1150 CE and possibly generated significant stress for Cahokia's inhabitants. Our findings implicate climate change during the Medieval Climatic Anomaly to Little Ice Age transition as an important component of population and sociopolitical transformations at Cahokia, and demonstrate how climate transitions can simultaneously influence multiple environmental processes to produce significant challenges to society.

Keywords: Cahokia | fecal stanols | paleodemography | paleoclimate

Significance: Our article examines the relationship between the population size of Cahokia, one of the most significant archaeological sites in North America, and evidence for major flooding and drought events. We use changes in the concentrations of fecal molecules contained in lake sediment as a proxy of population change and directly compare these variations with paleoenvironmental data from the same sediment core. These data show that a shift to decreased summer precipitation and a Mississippi River flood occurred circa 1150 CE, coinciding with a decline in the region's population and a major climate transition. Our study Highlights the importance of multiple, concurrent environmental stressors in combination with societal tensions as contributors to sociopolitical change.

Methoden

AMRHEIN 2019

Valentin Amrhein, Sander Greenland & Blake McShane, *Retire statistical significance*. [nature](#) **567** (2019), 305–307.

[n567-0305-Supplement.pdf](#)

Valentin Amrhein, Sander Greenland, Blake McShane and more than 800 signatories call for an end to hyped claims and the dismissal of possibly crucial effects.

For example, even if researchers could conduct two perfect replication studies of some genuine effect, each with 80% power (chance) of achieving $P < 0.05$, it would not be very surprising for one to obtain $P < 0.01$ and the other $P > 0.30$.