

## References

### Aktuell

ALEXANDER 2015

Amir R. Alexander, *Der Kampf um das unendlich Kleine*. [Spektrum der Wissenschaft](#) **2015**, x, 64–70.

Ein Vorläufer der heutigen Integralrechnung war im 17. Jahrhundert Gegenstand heftiger Auseinandersetzungen – und zwar vorrangig nicht aus wissenschaftlichen, sondern aus religiösen Gründen.

Der neue Zweig der Mathematik, der heute “Analysis“ oder auch “Ininitesimalrechnung“ (“Rechnen mit dem unendlich Kleinen“) heißt, wuchs zu zentraler Bedeutung heran. Ohne die Ininitesimalrechnung wäre insbesondere die moderne Physik nicht denkbar. In ihrer Frühzeit war jedoch wegen der überall lauenden Widersprüche unklar, welche Schlussweisen zulässig waren und welche nicht. Erst intensive Aufräumarbeiten im 19. Jahrhundert stellten die Sicherheit wieder her. Neben vielen anderen schufen namentlich Augustin Cauchy (1789–1857) und Karl Weierstraß (1815–1897) einen Aufbau der Analysis aus Axiomen, gegen den auch die Jesuiten nichts einzuwenden gehabt hatten.

In gewisser Form lebt allerdings der Gegensatz zwischen den “Fundamentalisten“ und den “Pragmatikern“ bis heute fort. Nach wie vor fallen in der Analysis die Findung eines Satzes und seine Bestätigung durch einen Beweis in der Regel auseinander. Letzterer beginnt typischerweise mit den berichtigten Worten “Sei  $\epsilon > 0$ “ und nimmt keinen Bezug auf die Intuition, die zu dem Satz geführt hat. Die Mathematiker -und vor allem die Physiker – hören nicht auf, in unendlich kleinen Größen zu denken, weil das so intuitiv einleuchtend ist und auch meistens auf den richtigen Weg führt, und müssen sich nachträglich vergewissern, dass sie nicht einem der allgegenwärtigen Paradoxa zum Opfer gefallen sind.

Das zeigt sich sogar in der Schreibweise. Die auf Leibniz zurückgehende Bezeichnung  $dx/dt$  für die Ableitung von  $x$  nach  $t$  sieht aus wie ein Bruch, und die Rechenregeln für die Ableitung sind denen für gewöhnliche Brüche manchmal zum Verwechseln ähnlich. Aber  $dx/dt$  ist eben nicht die unendlich kleine Größe  $dx$  geteilt durch die unendlich kleine Größe  $dt$ , denn die gibt es beide nicht, das heißt, sie sind nicht widerspruchsfrei deiniert.

Trotzdem ist es häufig hilfreich, nach dem Vorbild Cavalieris so zu tun, als gäbe es sie. Man muss nur das so gefundene Ergebnis nach dem Vorbild der Jesuiten durch einen Beweis absichern.

HAND 2015

Eric Hand, *Mantle plumes seen rising from Earth’s core*. [science](#) **349** (2015), 1032–1033.

Fat tubes of hot rock could alter views of how the planet cools.

That result is not enough to persuade Gillian Foulger, a geophysicist at Durham University in the United Kingdom, and a longtime skeptic of deep mantle plumes. Although she applauds the computational effort, she says that the whole waveform technique is still in its embryonic stages. She also notes that most of the plumes found by Romanowicz and French sit under hotspots in the ocean, where seismic data is extremely limited. “If your data is poor, you see a lot of noise,” she says.

## HENRIKSEN-LACEY 2015

Malou Henriksen-Lacey & Juan J. Giner-Casares, *Nice to know you. science* **349** (2015), 1254.

Several other mismatches between our fields cropped up. Materials scientists tend to focus on characterizing the material used in the experiment, while biologists primarily want to investigate how the material affects the cells. Planning biology experiments can be very complex; having to respect the life cycle of the cells or organisms can create challenges when collaborators are not used to working with this type of imposed schedule. Materials scientists are also generally expected to publish papers more quickly than biologists are, and biologists place more emphasis on clinical applications than materials scientists do. These differences can make it difficult to agree about when work is ready for publication.

So there you have it. Working closely with scientists from different backgrounds and listening to their scientific views can deepen your understanding of other fields—and improve your own research. We have never enjoyed our respective fields as much as we do right now, which we have achieved by stepping out of them. We encourage scientists interested in interdisciplinary research to get to know not only the work of colleagues but also the colleagues themselves; a huge field of scientific and personal joy is out there to explore.

## HILL 2015

Matthew Hill, *Be clear about the real risks. nature* **525** (2015), Supplement, S14.

The assertion that cannabis use can cause schizophrenia is not borne out by the evidence, says Matthew Hill.

There also seems to be no difference in schizophrenia rates between countries where cannabis use is prevalent and those where its use is rare. Again, if the drug were an instigating factor alone, we would expect to see differences in the population data.

Clearly, understanding the nature of the risk of schizophrenia is important when developing social policies surrounding cannabis. Education about the drug's effects on mental health should highlight the association of cannabis use with schizophrenia. But scientists should be careful with the language that they use, particularly when presenting this relationship to the public.

## MALYS 2015

Stephen Malys, John H. Seago, Nikolaos K. Pavlis, P. Kenneth Seidelmann & George H. Kaplan, *Why the Greenwich meridian moved. Journal of Geodesy* (2015), preprint, 1–10. DOI:10.1007/s00190-015-0844-y.

In 1884, the International Meridian Conference recommended that the prime meridian “to be employed as a common zero of longitude and standard of time-reckoning throughout the globe” pass through the “centre of the transit instrument at the Observatory of Greenwich”. Today, tourists visiting its meridian line must walk east approximately 102m before their satellite-navigation receivers indicate zero longitude. This offset can be accounted for by the difference between astronomical and geodetic coordinates—deflection of the vertical—in the east–west direction at Greenwich, and the imposed condition of continuity in astronomical time. The coordinates of satellite-navigation receivers are provided in reference frames that are related to the geocentric reference frame introduced by the Bureau International de l’Heure (BIH) in 1984. This BIH Terrestrial System provided the basis for orientation of subsequent geocentric reference frames, including all

realizations of the World Geodetic System 1984 and the International Terrestrial Reference Frame. Despite the lateral offset of the original and current zero-longitude lines at Greenwich, the orientation of the meridian plane used to measure Universal Time has remained essentially unchanged.

**Keywords:** Greenwich meridian | Deflection of the vertical | Prime meridian | ITRF zero meridian | IERS Reference Meridian | International Reference Meridian | International Terrestrial Reference Frame | Greenwich Mean Time

## SCHLICHTING 2015

H. Joachim Schlichting, *Das Schicksal einer Pfütze*. [Spektrum der Wissenschaft](#) **2015**, x, 56–57.

Die ästhetischen Rissmuster in ausgetrocknetem Sediment entstehen beim Zusammenspiel ganz unterschiedlicher physikalischer Vorgänge.

## TREMBLAY 2015

Marissa M. Tremblay et al., *Erosion in southern Tibet shut down at  $\approx 10$  Ma due to enhanced rock uplift within the Himalaya*. [PNAS](#) **112** (2015), 12030–12035.

pnas112-12030-Supplement1.avi, pnas112-12030-Supplement2.avi

Marissa M. Tremblay, Matthew Fox, Jennifer L. Schmidt, Alka Tripathy-Lang, Matthew M. Wielicki, T. Mark Harrison, Peter K. Zeitler & David L. Shuster

Exhumation of the southern Tibetan plateau margin reflects interplay between surface and lithospheric dynamics within the Himalaya–Tibet orogen. We report thermochronometric data from a 1.2-km elevation transect within granitoids of the eastern Lhasa terrane, southern Tibet, which indicate rapid exhumation exceeding 1 km/Ma from 17–16 to 12–11 Ma followed by very slow exhumation to the present. We hypothesize that these changes in exhumation occurred in response to changes in the loci and rate of rock uplift and the resulting southward shift of the main topographic and drainage divides from within the Lhasa terrane to their current positions within the Himalaya. At 17 Ma, steep erosive drainage networks would have flowed across the Himalaya and greater amounts of moisture would have advected into the Lhasa terrane to drive large-scale erosional exhumation. As convergence thickened and widened the Himalaya, the orographic barrier to precipitation in southern Tibet terrane would have strengthened. Previously documented midcrustal duplexing around 10 Ma generated a zone of high rock uplift within the Himalaya. We use numerical simulations as a conceptual tool to highlight how a zone of high rock uplift could have defeated transverse drainage networks, resulting in substantial drainage reorganization. When combined with a strengthening orographic barrier to precipitation, this drainage reorganization would have driven the sharp reduction in exhumation rate we observe in southern Tibet.

**Keywords:** Tibet–Himalaya | thermochronometry | landscape evolution

**Significance:** The Himalaya–Tibet plateau system formed by collision between India and Asia that began ca. 50 Ma and is still ongoing today. Despite being the most studied example of continent–continent collision, the evolution of topography in the Himalaya and Tibetan plateau remains an area of vigorous debate and active research. We present geochemical data on the cooling history of granites from the southern Tibetan plateau, which indicate that exhumation of these granites and therefore erosion rates in this region decreased significantly by  $\approx 10$  Ma after  $\approx 5$  Ma of rapid erosion. We hypothesize that this change in erosion rate reflects a tectonically imposed shift of the topographic and drainage divides south to their current positions within the Himalaya.

## Amerika

### CHAPUT 2015

Michelle A. Chaput, Björn Kriesche, Matthew Betts, Andrew Martindale, Rafal Kulik, Volker Schmidt & Konrad Gajewski, *Spatiotemporal distribution of Holocene populations in North America*. [PNAS 112 \(2015\), 12127–12132](#).

[pnas112-12127-Supplement00.pdf](#), [pnas112-12127-Supplement01.pdf](#), [pnas112-12127-Supplement02.pdf](#), [pnas112-12127-Supplement03.pdf](#), [pnas112-12127-Supplement04.pdf](#), [pnas112-12127-Supplement05.pdf](#), [pnas112-12127-Supplement06.pdf](#), [pnas112-12127-Supplement07.pdf](#), [pnas112-12127-Supplement08.pdf](#), [pnas112-12127-Supplement09.pdf](#), [pnas112-12127-Supplement10.wmv](#)

As the Cordilleran and Laurentide Ice Sheets retreated, North America was colonized by human populations; however, the spatial patterns of subsequent population growth are unclear. Temporal frequency distributions of aggregated radiocarbon (14C) dates are used as a proxy of population size and can be used to track this expansion. The Canadian Archaeological Radiocarbon Database contains more than 35,000 14C dates and is used in this study to map the spatiotemporal demographic changes of Holocene populations in North America at a continental scale for the past 13,000 y. We use the kernel method, which converts the spatial distribution of 14C dates into estimates of population density at 500-y intervals. The resulting maps reveal temporally distinct, dynamic patterns associated with paleodemographic trends that correspond well to genetic, archaeological, and ethnohistoric evidence of human occupation. These results have implications for hypothesizing and testing migration routes into and across North America as well as the relative influence of North American populations on the evolution of the North American ecosystem.

**Keywords:** Canadian Archaeological Radiocarbon Database | Holocene | North America | paleodemography | paleoecology

**Significance:** We provide the first maps to our knowledge of spatiotemporal paleodemographic growth following human migration into the Americas for the past 13,000 y, using a statistical approach that simultaneously addresses sampling and taphonomic biases. The Canadian Archaeological Radiocarbon Database is sufficiently complete in many areas, demonstrating high correspondence between continental-scale 14C-inferred population estimates and generally accepted archaeological history. Increases in population density seem robust for eastern and western North America, as well as central Alaska and the region surrounding Cahokia. These results are the first step toward being able to understand continentalscale human impacts on the North American ecosystem during the Holocene as well as demographic growth and migrations in relation to environmental changes.

## Anthropologie

### GIBBONS 2015

Ann Gibbons, *New human species discovered, Bizarre skeletons emerge from South African cave*. [science 349 \(2015\), 1149–1150](#).

Although the fossils are still undated, making it hard to know where they sit in the human family tree, they already reveal a profoundly different way to be a member of our genus Homo. “There is no doubt in my mind that this is a new species,” Grine says.

The skull was globular, like a member of our genus *Homo*, but the brain was small and primitive. The wrist suggested this species was an adept toolmaker, but its shoulder and fingers showed it still climbed in trees, like more primitive hominins. “We were facing something that was different from anything else that had been described,” Berger says.

In a separate analysis of the foot, paleoanthropologist William Harcourt-Smith of the American Museum of Natural History in New York City and his colleagues noted that its proportions were modern and the big toe was aligned with the other toes, rather than diverging like an ape’s grasping big toe. Taken together, the hand and foot suggest “you have a creature that would have walked upright really well but also would have been comfortable in the trees,” Harcourt-Smith says. Harvard University paleoanthropologist Dan Lieberman agrees: “The foot is indeed strikingly modern . . . and suggests it walked and possibly ran much like modern humans.”

## SUDMANT 2015

Peter H. Sudmant et al., *Global diversity, population stratification, and selection of human copy-number variation*. [science](#) **349** (2015), 1181.

[s349-1181-Supplement0.pdf](#), [s349-1181-Supplement1.xlsx](#), [s349-1181-Supplement2.xlsx](#), [s349-1181-Supplement3.xlsx](#), [s349-1181-Supplement4.xlsx](#), [s349-1181-Supplement5.xlsx](#)

Peter H. Sudmant, Swapan Mallick, Bradley J. Nelson, Fereydoun Hormozdiari, Niklas Krumm, John Huddleston, Bradley P. Coe, Carl Baker, Susanne Nordenfelt, Michael Bamshad, Lynn B. Jorde, Olga L. Posukh, Hovhannes Sahakyan, W. Scott Watkins, Levon Yepiskoposyan, M. Syafiq Abdullah, Claudio M. Bravi, Cristian Capelli, Tor Hervig, Joseph T. S. Wee, Chris Tyler-Smith, George van Driem, Irene Gallego Romero, Aashish R. Jha, Sena Karachanak-Yankova, Draga Toncheva, David Comas, Brenna Henn, Toomas Kivisild, Andres Ruiz-Linares, Antti Sajantila, Ene Metspalu, Jüri Parik, Richard Villems, Elena B. Starikovskaya, George Ayodo, Cynthia M. Beall, Anna Di Rienzo, Michael F. Hammer, Rita Khusainova, Elza Khusnutdinova, William Klitz, Cheryl Winkler, Damian Labuda, Mait Metspalu, Sarah A. Tishkoff, Stanislav Dryomov, Rem Sukernik, Nick Patterson, David Reich & Evan E. Eichler

In order to explore the diversity and selective signatures of duplication and deletion human copy-number variants (CNVs), we sequenced 236 individuals from 125 distinct human populations. We observed that duplications exhibit fundamentally different population genetic and selective signatures than deletions and are more likely to be stratified between human populations. Through reconstruction of the ancestral human genome, we identify megabases of DNA lost in different human lineages and pinpoint large duplications that introgressed from the extinct Denisova lineage now found at high frequency exclusively in Oceanic populations. We find that the proportion of CNV base pairs to single-nucleotide-variant base pairs is greater among non-Africans than it is among African populations, but we conclude that this difference is likely due to unique aspects of non-African population history as opposed to differences in CNV load.

However, we find that the proportion of human variation that can be ascribed to CNVs rather than to SNVs is greater among non-Africans than among Africans. The biological significance of this difference should be interpreted cautiously and will require association studies to determine its relevance to disease and other phenotypic differences.

## WONG 2015

Kate Wong, *Verkannte Neandertaler*. [Spektrum der Wissenschaft](#) **2015**, x, 28–35.

Neue archäologische, anatomische und genetische Befunde zeigen: Unsere nächsten Verwandten hatten unerwartet hohe geistige Fähigkeiten.

Henry kommentiert: “Wie wir diese Daten auch drehen und wenden, nie ergibt sich ein wirklicher Unterschied zum Homo sapiens. Im Augenblick sieht es nicht so aus, als ob sich die ersten modernen Menschen in Europa auf Pflanzennahrung besser verstanden hätten.” Wenn die Neandertaler tatsächlich über einiges “moderne” Verhalten verfügten, ist es umso rätselhafter, wieso sie ausstarben. Eine Theorie dazu besagt: Die Vertreter von Homo sapiens besaßen schon vorher das größere und bessere Werkzeug- und Waffenarsenal, was es ihnen erlaubte, ihre Nahrungsbeschaffung effizienter zu gestalten.

Einige Forscher stellen sich den Untergang der Neandertaler gar nicht einmal dramatisch vor. Sie postulieren, ihr Genpool könne in dem der modernen Menschen einfach versunken, ihre Population verschluckt worden sein. Fraser sinniert: “Zahlreich waren sie nie. Dann tauchten andere Menschen auf, die sich mit ihnen vermischten, und dadurch verschwanden sie allmählich. Alle Lebensformen sterben letztlich aus. Das Schicksal der Neandertaler muss nicht bedeuten, dass sie zu dumm, zu wenig kulturbegabt oder nicht anpassungsfähig waren.”

## Biologie

CEBRIAN 2015

Just Cebrian, *Energy flows in ecosystems*. [science 349 \(2015\), 1053–1054](#).

Relationships between predator and prey biomass are remarkably similar in different ecosystems.

HATTON 2015

Ian A. Hatton et al., *The predator-prey power law, Biomass scaling across terrestrial and aquatic biomes*. [science 349 \(2015\), 1070](#).

[s349-1070-Supplement1.pdf](#), [s349-1070-Supplement2.xls](#)

Ian A. Hatton, Kevin S. McCann, John M. Fryxell, T. Jonathan Davies, Matteo Smerlak, Anthony R. E. Sinclair & Michel Loreau

Ecosystems exhibit surprising regularities in structure and function across terrestrial and aquatic biomes worldwide. We assembled a global data set for 2260 communities of large mammals, invertebrates, plants, and plankton. We find that predator and prey biomass follow a general scaling law with exponents consistently near ①. This pervasive pattern implies that the structure of the biomass pyramid becomes increasingly bottom-heavy at higher biomass. Similar exponents are obtained for community production-biomass relations, suggesting conserved links between ecosystem structure and function. These exponents are similar to many body mass allometries, and yet ecosystem scaling emerges independently from individual-level scaling, which is not fully understood. These patterns suggest a greater degree of ecosystem-level organization than previously recognized and a more predictive approach to ecological theory.

LAURANCE 2015

William F. Laurance, *Wildlife struggle in an increasingly noisy world*. [PNAS 112 \(2015\), 11995–11996](#).

Ware et al.’s study elegantly incorporated two types of experimental control. The first was a matched ridgeline in the same area that lacked road noise. For the second control, they turned the speakers on their phantom road on and off at 4-d intervals, so that the road effectively appeared and disappeared acoustically.

This process allowed them to infer the effects of road noise on the abundance and behavior of birds with an unusually high degree of confidence.

#### WARE 2015

Heidi E. Ware, Christopher J. W. McClure, Jay D. Carlisle & Jesse R. Barber, *A phantom road experiment reveals traffic noise is an invisible source of habitat degradation*. [PNAS 112 \(2015\), 12105–12109](#).

[pnas112-12105-Supplement1.xlsx](#), [pnas112-12105-Supplement2.csv](#), [pnas112-12105-Supplement3.csv](#), [pnas112-12105-Supplement4.csv](#), [pnas112-12105-Supplement5.wmv](#), [pnas112-12105-Supplement6.wmv](#)

Decades of research demonstrate that roads impact wildlife and suggest traffic noise as a primary cause of population declines near roads. We created a “phantom road” using an array of speakers to apply traffic noise to a roadless landscape, directly testing the effect of noise alone on an entire songbird community during autumn migration. Thirty-one percent of the bird community avoided the phantom road. For individuals that stayed despite the noise, overall body condition decreased by a full SD and some species showed a change in ability to gain body condition when exposed to traffic noise during migratory stopover. We conducted complementary laboratory experiments that implicate foraging-vigilance behavior as one mechanism driving this pattern. Our results suggest that noise degrades habitat that is otherwise suitable, and that the presence of a species does not indicate the absence of an impact.

**Keywords:** traffic noise pollution | songbird migration | habitat degradation | foraging-vigilance trade-off | perceived predation risk

**Significance:** Using landscape-scale traffic noise playbacks to create a “phantom road,” we find that noise, apart from other factors present near roads, degrades the value of habitat for migrating songbirds. We found that nearly one third of the bird community avoided the phantom road. For some bird species that remained despite noise exposure, body condition and stopover efficiency (ability to gain body condition over time) decreased compared with control conditions. These findings have broad implications for the conservation of migratory birds and perhaps for other wildlife, because factors driving foraging behavior are similar across animals. For wildlife that remains in loud areas, noise pollution represents an invisible source of habitat degradation.

## Energie

#### SERVICE 2015

Robert F. Service, *Tailpipe to tank*. [science 349 \(2015\), 1158–1160](#).

Researchers are vying to use renewable energy to suck carbon dioxide out of the air and turn it back into fuel.

One such approach is already commercial. In Iceland, a company called Carbon Recycling International opened a plant in 2012 that uses renewable energy to create syngas. The company harnesses the island’s abundant geothermal energy to produce electricity, which drives electrolysis machines that split CO<sub>2</sub> and water. The resulting syngas is then turned into methanol.

## Jungpaläolithikum

#### MARIOTTI LIPPI 2015

Marta Mariotti Lippi, Bruno Foggi, Biancamaria Aranguren, Annamaria Ronchitelli & Anna Revedin, *Multistep food plant processing*

at *Grotta Paglicci (Southern Italy)* around 32,600 cal B.P. [PNAS 112 \(2015\), 12075–12080](#).

Residue analyses on a grinding tool recovered at Grotta Paglicci sublayer 23A [32,614 ± 429 calibrated (cal) B.P.], Southern Italy, have demonstrated that early modern humans collected and processed various plants. The recording of starch grains attributable to *Avena* (oat) caryopses expands our information about the food plants used for producing flour in Europe during the Paleolithic and about the origins of a food tradition persisting up to the present in the Mediterranean basin. The quantitative distribution of the starch grains on the surface of the grinding stone furnished information about the tool handling, confirming its use as a pestle-grinder, as suggested by the wear-trace analysis. The particular state of preservation of the starch grains suggests the use of a thermal treatment before grinding, possibly to accelerate drying of the plants, making the following process easier and faster. The study clearly indicates that the exploitation of plant resources was very important for hunter-gatherer populations, to the point that the Early Gravettian inhabitants of Paglicci were able to process food plants and already possessed a wealth of knowledge that was to become widespread after the dawn of agriculture.

**Keywords:** starch grains | *Avena* | pestle-grinder | flour | Early Gravettian

**Significance:** The Early Gravettian inhabitants of Grotta Paglicci (sublayer 23 A) are currently the most ancient hunter-gatherers able to process plants to obtain flour. They also developed targeted technologies for complex processing of the plant portions before grinding. The present study testifies for the first time, to our knowledge, the performance of a thermal pretreatment that could have been crucial in a period characterized by a climate colder than the current one. The starch record on the Paglicci grinding stone is currently the most ancient evidence of the processing of *Avena* (oat).

## Klima

### KAPTUÉ 2015

Armel T. Kaptué, Lara Prihodk & Niall P. Hana, *On regreening and degradation in Sahelian watersheds*. [PNAS 112 \(2015\), 12133–12138](#).

Over many decades our understanding of the impacts of intermittent drought in water-limited environments like the West African Sahel has been influenced by a narrative of overgrazing and human-induced desertification. The desertification narrative has persisted in both scientific and popular conception, such that recent regional-scale recovery ("regreening") and local success stories (community-led conservation efforts) in the Sahel, following the severe droughts of the 1970s–1980s, are sometimes ignored. Here we report a study of watershed-scale vegetation dynamics in 260 watersheds, sampled in four regions of Senegal, Mali, and Niger from 1983–2012, using satellite-derived vegetation indices as a proxy for net primary production. In response to earlier controversy, we first examine the shape of the rainfall–net primary production relationship and how it impacts conclusions regarding greening or degradation. We conclude that the choice of functional relationship has little quantitative impact on our ability to infer greening or degradation trends. We then present an approach to analyze changes in long-term (decade-scale) average rain-use efficiency (an indicator of slowly responding vegetation structural changes) relative to changes in interannual-scale rainfall sensitivity (an indicator of landscape ability to respond rapidly to rainfall variability) to infer trends in greening/degradation of the watersheds in our sample regions. The predominance of increasing rain-use efficiency in our data supports earlier reports of

a “greening” trend across the Sahel. However, there are strong regional differences in the extent and direction of change, and in the apparent role of changing woody and herbaceous components in driving those temporal trends.

**Keywords:** Sahel | desertification | rain-use efficiency | drylands | West Africa

**Significance:** For decades, the science and policy narrative relating to the West African Sahel has focused on perceptions of overgrazing and human-induced desertification. More recent reports of regional-scale recovery (“regreening”) following the severe droughts of the 1970s and 1980s are sometimes ignored. This study provides a satellite-based evaluation of changes in watershed-scale vegetation conditions in four regions of the Sahel from 1983–2012. Though the results support earlier reports of a “greening” trend, our approach identified strong regional differences in the extent and direction of change, and in the apparent role of woody and herbaceous components in driving the temporal trend.

## LANDSCHÜTZER 2015

Peter Landschützer et al., *The reinvigoration of the Southern Ocean carbon sink*. [science](#) **349** (2015), 1221–1224.

[s349-1221-Supplement.pdf](#)

Peter Landschützer, Nicolas Gruber, F. Alexander Haumann, Christian Rödenbeck, Dorothee C. E. Bakker, Steven van Heuven, Mario Hoppema, Nicolas Metzler, Colm Sweeney, Taro Takahashi, Bronte Tilbrook & Rik Wanninkhof

Several studies have suggested that the carbon sink in the Southern Ocean—the ocean’s strongest region for the uptake of anthropogenic CO<sub>2</sub>—has weakened in recent decades. We demonstrated, on the basis of multidecadal analyses of surface ocean CO<sub>2</sub> observations, that this weakening trend stopped around 2002, and by 2012 the Southern Ocean had regained its expected strength based on the growth of atmospheric CO<sub>2</sub>. All three Southern Ocean sectors have contributed to this reinvigoration of the carbon sink, yet differences in the processes between sectors exist, related to a tendency toward a zonally more asymmetric atmospheric circulation. The large decadal variations in the Southern Ocean carbon sink suggest a rather dynamic ocean carbon cycle that varies more in time than previously recognized.

## MIKALOFF-FLETCHER 2015

S. E. Mikaloff-Fletcher, *An increasing carbon sink?* [science](#) **349** (2015), 1165.

Southern Ocean carbon uptake may have strengthened between 2002 and 2012, slowing climate change.