Hotspots and species diversity

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MEAN TEMPERATURE OF LOWER TROPOSPHERE FOR DAYS OF THE WEEK

	Globe		NH		SH	
	Temp.	s.d.	Temp.	s.d.	Temp.	s.d.
Sunday	−4.95	0.2276	−7.71	0.2856	−2.37	0.2595
Monday	−2.57	0.2254	−2.88	0.2847	−2.38	0.2611
Tuesday	1.13	0.2273	3.54	0.2838	−1.30	0.2580
Wednesday	6.14	0.2253	11.34	0.2789	1.15	0.2593
Thursday	0.65	0.2234	1.38	0,2749	.18	0.2607
Friday	2.56	0.2224	.08	0,2767	5.04	0.2607
Saturday	−2.84	0.2214	−5.88	0.2788	.06	0.2551

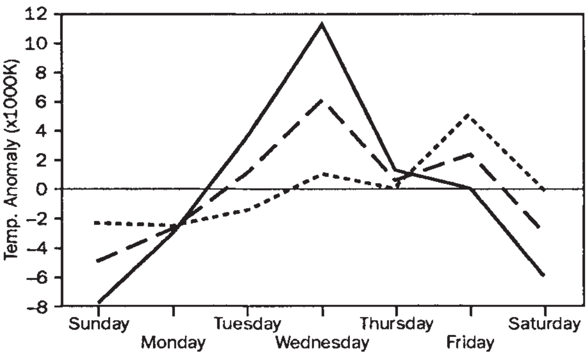
Temperature in °C and normalized × 1,000; s.e. of daily values is 0.06 °C s.d. in °C.

cally by an enhanced greenhouse effect. But it might be possible to detect a heat signal from human-induced activities according to the days of the week because industrial activity throughout much of the world eases to some extent during weekends. In addition, commuter automobile traffic is also reduced (despite some increase in recreational driving). The 5-day working week exists in many western industrial countries, and Friday is a holiday in the Muslim world.

I have therefore tabulated daily satellite temperature anomalies for the 7 days of the week. The series stretched from 1 January 1979 (a Monday) to 30 November 1992, a total of 5,083 days. Neglecting the final day, the series composed 726 weeks. There were a few missing observations, but not many. The latter intervening missing observations days were allocated linearly extrapolated values, and the results are shown in the figure and table.

The broad sine-curve variation for the days of the week exhibited by the Northern Hemisphere is quite remarkable: the anomalies agree with the hypothesis that a human-induced heat signal is present. The puzzling peak on Wednesdays could be explained by the fact that the new weekday in the dataset occurs at noon at Greenwich (Universal Time). Thus at midday on Thursday, Friday is already starting to move over the eastern half of the world. This argument favours a possible Wednesday maximum in the Northern Hemisphere, where the Muslim faith is more predominant east of the Greenwich meridian. A further argument to explain the Wednesday peak could be that various holidays in the Western world tend to congregate between Wednesday and Tuesday. For example at least 2% of Thursdays are Thanksgiving holidays in the United States, while the effect of Fridays is even more pronounced.

The variation in the Southern Hemisphere, which appears to lag about 2 days after the Northern Hemisphere, is less clearly defined. The difference may reflect the different land and ocean proportions, as there is approximately twice as much land in the Northern than the Southern Hemisphere, and so the proportions of human induced heat activity would be much greater in the North. A more detailed analysis of land versus ocean coverage is not yet possible on the time scale of a day with the MSU satellite set.



Mean temperature anomalies for the lower troposphere. Solid line, Northern Hemisphere; dotted line, Southern Hemisphere; dashed line, globe.

A one-tailed *t*-test is appropriate as the prediction is that the warm peak should occur mid-week and the cold minimum at the week end. The *t*-test then indicates that the difference in the means between Sunday and Wednesday in the Northern Hemisphere curve is significant to the 10% level. Although the significance does not reach the orthodox 5% level, it is meaningful. A sign test of the differences between Wednesdays and Sundays indicates better than 5% significance. The Southern Hemisphere curve is not significant to any acceptable level. Although the amplitude of the curve is only about 0.01 K, the rate of change of 0.02 K in 3.5 days is 70 times greater than the predicted enhanced greenhouse trend of 0.3 K per decade.

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Hotspots and species diversity

SIR — Using data from the British Isles for several groups of organisms, Prendergast *et al.*[1] found only "weak support" for the principle that conserving areas of highest species diversity ('hotspots') is the best way to conserve rare species. For one of their groups, birds, we are able to test their conclusions using published, coarse-resolution data on the terrestrial birds of Australia[2], a landmass that is larger, much less populated, and contains a greater diversity of habitats than Britain. Although we find some similarities, there are important differences between the results of the two studies.

Prendergast *et al.* used a spatial resolution of 10-km squares and defined rare species as those occupying <16 out of 2761 squares (32 of 206 species). We used data with a resolution of 1°×1° (~100-km squares) and a proportionally similar definition of rare Australian species: those occupying <5 out of 812 squares (30 of 433 species). In both studies, hotspots were the top 5% of squares ranked by total number of species.

Like Prendergast *et al.*, we find that about half of rare bird species do not occur in hotspots (54.4% in Australia and 43% in Britain). But in contrast, we find that 47% of Austalian hotspots contain at least one rare bird species, compared to only 22% of British hotspots. Only one rare Australian bird species is located in a 'coldspot', compared to 19% of rare British birds.

These similarities and differences support two suggestions of Prendergast *et al.*, that their results are both scale-dependent and specific to fragmented landscapes (such as the British Isles). At progressively coarser scales of resolution, rare species and hotspots will tend to be coincident because sampling squares will 'need' rare species to become unusually species-rich. If landscapes have different levels of fragmentation, then greater fragmentation can leave the rare species stranded capriciously in widely scattered areas, each containing relatively few species. Britain is much more fragmented than Australia, which could explain our second result that rare species contribute more to Australian hotspots than to British ones. Most British hotspots are apparently composed of many relatively common species, whereas half of Australian hotspots contain some rare species, and a few are virtually defined by rare species (areas of high endemism). Finally, Australian coldspots are likely to have much lower species diversity ▶

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than those in Britain, resulting in relative absence of rare species.

We agree that species diversity should not be the sole criterion for identifying areas for conservation, but our evidence suggests that the relationship between diversity and rarity is dependent on both the fragmentation of the landscape and the scale under consideration. Discovering the exact nature of this relationship is of considerable interest for conservation purposes. Targeting areas of high diversity may be the best way to protect rare species only if very large areas are available for conservation.

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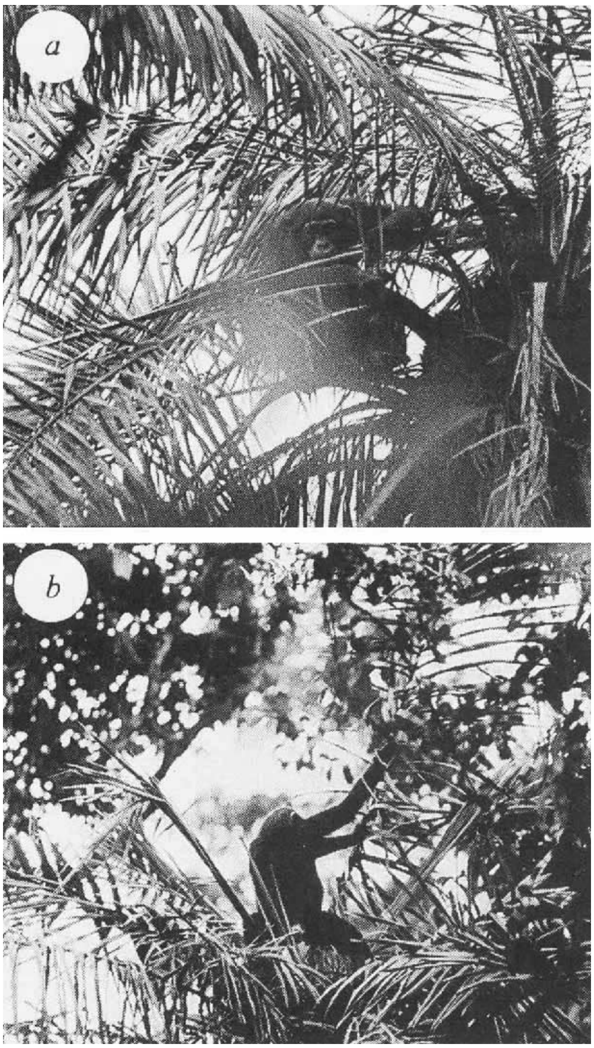
Tool use by wild chimpanzees

SIR — Wild chimpanzees at Bossou, in the Republic of Guinea, West Africa, extract sap from oil-palm trees with a "pestle", and then drink it using a "fibre-sponge". This behaviour includes the use of techniques similiar to those used when wild chimpanzees use other tools, such as the stone hammer-and-anvil[1,2], the digging-stick[3,4], and the leaf-sponge[5]. However, both squeezing the sap and the use of the pestle have not, to my knowledge, been reported previously (see ref. 6).

In the periphery of the core-area of a wild chimpanzee group at Bossou Oil-palm trees (*Elaeis guineensis*) are frequently found. A mature tree is more than 20 m in height and its top is covered with 20–40 large pinnate compound leaves. A hard leaf-stalk (petiole) reaches 5 m in length and 5–10 cm in breadth. All resident members of the chimpanzee group have been identified since 1976; the group consisted of about 20 chimpanzees throughout the study period.

Chimpanzees come to feed on oil-palm nuts using hammer-and-anvil stones. Some of them climb on the top of the tree, stand on two legs, grasp an upright young leaf-stalk in the centre of the crown with both hands and pull it out from the tree with great force. Even for an adult chimpanzee it takes more than a minute to detach it. After taking off a leaf-stalk from the tree he or she bites its white base and sucks sap from it (*a* in the figure).

On 7 January 1990, in the driest season, after taking and throwing away more than 5 young stalks, an old female of about 40 years bit off thorns of a stalk with her incisors, stood up on two legs at the edge of the tree-top and pounded its centre vertically with the stalk, as if she were pounding grain with a mortar and pestle. After 10 poundings with both hands and with much force, a hole appeared in the centre of the tree-top. The chimpanzee put her left hand in the hole and picked up a handful of drenched fibre which she had made by the repeated poundings. She sucked it as she would a sponge. She dropped it into the hole, brought it up and sucked again. She also licked her drenched hand. After she climbed down the tree an adolescent male climbed up. He took off a leaf-stalk from the tree and did the same as the old female (*b* in the figure). He pounded 10 times with both hands and 6 times with his right hand. He squatted and put his left hand into the deep hole which must have been more than 30 cm in depth as his elbow was completely in the hole. He repeatedly brought up a lump of fibre from the bottom of the hole and sucked sap from it.



a, Adolescent chimpanzee biting and sucking sap from the base of a young leaf-stalk. *b*, Adolescent chimpanzee pounding the hole at the top of a palm tree with a leaf-stalk as the "pestle".

Many adult and adolescent chimpanzees at Bossou were seen every dry season to pull out palm leaf-stalks; however, the combined work of the "pestle pounding" and "fibre-sponge sucking" was confirmed for only four episodes in two adult females (estimated 30 and 40 years old) and two adolescents (9-years old male and 8-years-old female).

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Sex-ratio and inheritance

SIR — The theoretical implications of the reported inheritance of acquired characters in Mongolian gerbils[1] are so important that the evidence should be assessed most critically.

Clark *et al.* report[1] that adult female gerbils who gestated between two male fetuses (2M females) produce litters with a significantly greater proportion of sons than those (2F) mothers who gestated between females. Gestation of females adjacent to males causes their androgenization. If the report is valid, female offspring of 2M mothers have an enhanced chance of also being 2M, and the masculinized phenotype will tend to be perpetuated.

But Clark *et al.* do not report the significance of departure of the sex ratio from 50% in litters born to 2M mothers; the excess of males in these litters (57.1%) was similar to their deficit in those of 2F (43.7%). The androgization theory they proposed provides no explanation for the latter figure.

Clark *et al.* have elsewhere shown[2] that prepartum gerbil litters overall contain equal numbers of the sexes, irrespective of litter size, but that litter size correlates with sex-biased perinatal losses. They suggest that mothers of small litters selectively cannibalize their own new-born