that the price per metric ton of CO_2 C would fall from \$4.18 in an unregulated situation to \$1.04 under best management practices using a 30-year time-frame with 3% discount rate (see Table 2 of our report).

Land use and forestry measures in climate change mitigation continue to be a contentious issue among delegates and observers to the Kyoto Protocol, and the challenge of determining baselines is part of this important debate. Including forest conservation in the Clean Development Mechanism (CDM) can be done credibly. It will give countries that want to keep their forests intact a source of conservation financing that is otherwise unavailable (*1*). Currently, many countries are receiving better offers from loggers (*2*). Until the world community compensates developing countries for the opportunity cost of not cutting their trees, we can expect this global baseline to continue unabated, causing an estimated 1.6 gigatons of carbon emissions each year (*3*).

Lastly, protecting existing tropical forests will, in addition to reducing greenhouse gas emissions, also maintain historical land surface conditions such as the hydrological cycle, the partitioning of latent and sensible heat, cloud cover, and other factors that modulate climate and weather. Most general circulation models and experimental data suggest that together these factors generally result in a net localized surface cooling of a few degrees celsius (*4*). In this regard, conserving existing tropical forests will produce secondary and tertiary benefits for climate stability that fossil-fuel reductions alone cannot provide.

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References and Notes

1. Fourteen countries submitted a position paper on this issue noting that, legally, forest conservation is eligible for activities under the CDM of the Kyoto Protocol. They argued that excluding this source of emissions would also deprive them of opportunities for sustainable development. Framework Convention on Climate Change document #FCC/SB/2000/MISC.1/Add.2.
2. "Buying destruction: A Greenpeace report for corporate consumers of forest products" (Greenpeace International, Amsterdam, 1999).
3. "Intergovernmental panel on climate change: Land use, land-use change and forestry" (Cambridge Univ. Press, Cambridge, 2000).
4. K. L. O'Brien, *Clim. Change* **44**, 311 (2000); J. Shukla, C. Nobre, P. Sellers, *Science* **247**, 1322 (1990); J. Lean and D. A. Warrilow, *Nature* **342**, 411 (1989).

Di Leva raises an important question as to how to establish appropriate emission baselines for greenhouse gas emission reduction projects under the Kyoto Protocol's CDM so as not to penalize developing countries that enact and enforce strong environmental laws. However, as Di Leva points out, this is not a concern that applies only to forest conservation projects in the CDM; it applies equally to projects in the energy sector. As such, the issue raised by Di Leva does nothing to undermine our call to include forest conservation as an eligible activity under the Kyoto Protocol.

Nonetheless, project baseline calculation requires considerable attention. The Kyoto Protocol requires that emission reductions under CDM projects be in addition to those that would have occurred in the absence of the project. Such a standard is counter-factual and, therefore, may prove challenging to implement for many projects. Perverse incentives with respect to enacting and enforcing environmental laws could be avoided if emission baselines are set by using deforestation rates that precede instigation of the CDM. The downside of such an approach is that baselines based on historic trends could result in outdated data for long-term projects. An alternative approach would be to require dynamic baselines that would be altered to reflect changes in environmental laws or other factors. For example, the deforestation baseline initially established for the Noel Kempff Mercado Climate Action Project was subsequently recalculated to reflect strengthened forest protection laws in Bolivia. The fact that the Bolivian government will receive a sizeable share of the greenhouse gas emission reduction credits generated by the 600,000-hectare project seems not to have dampened efforts to improve environmental laws there.

However baselines are calculated, countries with poor environmental records and thus greater potential for greenhouse gas emission reductions may theoretically attract more investment, as Di Leva points out. In practice, this may not be the case because the lack of stable democratic and legal institutions that often accompany environmental degradation increase the risk of project failure and thus may give project investors pause. However, because at least some investment is likely to flow to countries with spotty environmental credentials, it is vital that international negotiators develop rules that ensure the environmental integrity, protection of indigenous people's land tenure, and transparency of all CDM projects.

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Less Is Moa

In their report "Rapid extinction of the moas (Aves: Dinornithiformes): Model, test, and implications" (24 Mar., p. 2250), Holdaway and Jacomb contribute a useful zoological model for moa extinction, but they compare uncalibrated radiocarbon determinations [750 to 400 years before the present (yr B.P.)] for the established model of moa hunting, with their calibrated age range (about 1280–1380 A.D. up to 1440 A.D.) (*1*). Established model determinations calibrate to 1280–1450 A.D., only 10 years longer than in one of their simulations (simulation A). Furthermore, moa hunting was potentially continuous in coastal areas, and extirpation probably occurred more rapidly on the Canterbury Plains adjacent to the Monck's Cave site than in interior hill country. Thus, moa extinction generally cannot be tested from that site, and many archaeological data, not mentioned by the authors, may contradict that case. For example, the Italian Creek site in Cromwell Gorge (*2*), burnt moa eggshell from two species was concentrated around one hearth dated [error of two standard deviations (2σ)] 1246–1611 A.D. (NZ-4716) and another dated 1332–1664 A.D. (NZ-4714) and 1432–1943 A.D. (NZ-4715, 0.883 of area under probability curve is 1432–1686 A.D.).

Twenty-five additional archaeological sites containing moa bone have radiocarbon dates on charcoal that extend into the 15th century. In addition, although some radiocarbon determinations on moa bone are problematic, a critical analysis (*3*) indicates that 14 calibrated ages (2σ) can be accepted from five archaeological sites that extend into the 15th century or later. Among possible late kills are NZA-558 (1431–1483 A.D.) from Tairua (North Island), and from South Island NZ-7739 (1480–1636 A.D.) from Shag River and NZA-825 (1487–1945 A.D.) from Tumbledown Bay.

The current archaeological data do not permit an inference of moa extinction earlier than in the established model (1450 A.D.). This implies human-moa interaction for at least 170 years.

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References and Notes

1. See references (*2, 3, 11, 18*) in Holdaway and Jacomb's report.
2. N. A. Ritchie, *N. Z. J. Archaeol.* **4**, 21 (1982).
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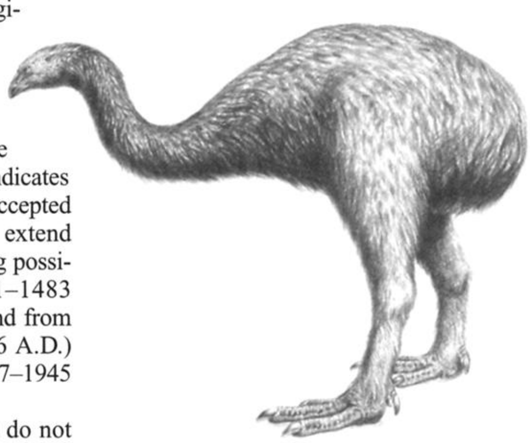
Response

Regarding the radiocarbon determinations, we gave the orthodox duration of moa hunting in New Zealand as a range of conventional radiocarbon ages (CRA); we did not compare that range directly with calibrated ages. The age range was given as CRA to facilitate comparison with date ranges that are usually given in radiocarbon years in previous literature. Measurement of CRA involves an error that extends the range of calendar years corresponding to each CRA measurement: so a radiocarbon age range of 750 to 400 yr B.P. does not correspond to 1280–1380 A.D. With errors normally associated with dates on moa bone and other materials, the calibrated age range for CRAs of 750–400 yr B.P. is about 1200–1550 A.D., which is the conventional calendar range for the period of moa hunting.

"Late" dates on moa bone can arise for various reasons. Almost all the dates cited by Anderson as possibly indicating late kills were gas count dates on bone collagen rather than purified gelatin. They were measured before 1993, using an alkali treatment protocol that did not efficiently remove humates (*1*). Collagen samples large enough for gas count dates can contain significant amounts of humates and other contaminants and can yield dates several centuries too young (*2*). At Tairua (North Island), two dates (calibrated ages: Wk-5444, 1306–1404 A.D.; Wk-5445, 1250–1313 A.D.) not mentioned by Anderson were on marine shell from the same layer (*3*) and firmly in the period predicted by our model. We cannot see why one moa collagen date was preferred over two marine shell dates (agreeing at 1σ) from the same educational layer.



SOURCE: ANDREW CALDWELL

Monck's Cave is an ideal site by which to test the end of moa hunting. It is in the optimal zone for moa hunting in the eastern South Island, is 200 meters from a large site containing Archaic artefacts and copious evidence for consumption of moas, and is demonstrably post–moa hunting in economy, settlement pattern, and material culture.

Although moas may have survived longer in the interior than elsewhere, dates on inland sites do not support a longer period of hunting. Inland sites are relatively rare, predominantly small, and occupied only briefly. Accelerator mass spectrometry dates on moa bone collagen and charcoal from Takahe Valley (in a mountainous, remote area of the South Island) indicate that moas were being hunted and eaten well away from the east coast by the middle of the 14th century (*4*). The few dated inland Canterbury sites, such as a small kill site near Lake Coleridge (Wk-6766, 2σ calibrated age 1305–1434 A.D. on moa bone protein) (*5*), are consistent with our model (*6*).

At Italian Creek, two of three calibrated dates have ranges that overlap with the age range predicted by our model described in our report. Those dates cannot falsify the model. The third (NZ-4715) extends only to 1432, within the upper limit allowed by our model.

Furthermore, the burnt moa eggshell was not necessarily associated with human occupation. No moa bone was reported from the site, and unrecognized mixing of natural and archaeological artefacts in such shelters is not unknown. Many rock shelters in New Zealand have natural fossil faunas; many were also moa nest sites (*6, 7*).

The 25 additional archaeological sites Anderson mentions might have dates for which error ranges reach the 15th century, but most, if not all, have dates that are predominantly within the 14th century. For example, NZA-825 on alkali-treated moa bone collagen (*3*) from the bottom of the basal layer at Tumbledown Bay (*8*) is both equivocally associated with the dated occupation and possibly too young. NZ-7739 from Shag River Mouth, used by Anderson to support late hunting, is from a suite of dates on moa bone collagen previously discarded as being too variable and subject to error (*9*). From dates on other materials, it was concluded that moa hunting there lasted a few decades in the mid to late 14th century (*10*).

The spread of possible calendar dates arising from the calibration process precludes inference of a date for the end of moa hunting. Hence, we chose to date the earliest site where moa were not available in the environment, so "capping" the moa hunting period.

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9. A. J. Anderson, I. Smith, T. Higham, in *Shag River Mouth: The Archaeology of an Early Southern Maori Village*, A. Anderson, B. Allingham, I. Smith, Eds. (ANH Publications, Research School of Pacific and Asian Studies, Australian National University, Canberra, Australia, 1996), chap. 7.
10. A. J. Anderson and I. Smith, in (*9*), chap. 20.

CORRECTIONS AND CLARIFICATIONS

Reports: "*PAX8-PPARγ1* fusion oncogene in human thyroid carcinoma" by T. G. Kroll *et al.* (25 Aug., p. 1357). The title of this report was incorrect when published. Two words in the title, "oncogene" and "in," were mistakenly transposed during the editing process.

News Focus: "Creation's seventh day" by Robert F. Service (14 July, p. 232). The space-filling model of DNA on page 235 and repeated in the Table of Contents (p. 208) was printed incorrectly. It should have depicted a right-handed helix instead of the left-handed one shown.

Random Samples: "Head count" (12 May, p. 959). The affiliation of Jeffrey Lieberman in the accompanying table was incorrect. He is at the University of North Carolina.