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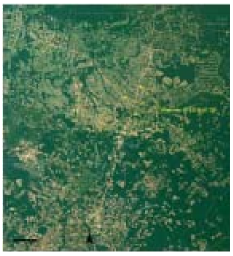


Environmental Hotspot Alert

Amazonian Deforestation Slowing but May Already be at a Tipping Point—Mato Grosso, Brazil

Road building in the Amazon has encouraged deforestation; by 2009, Mato Grosso had lost so much forest that declines in rainfall and soil fertility may mean secondary forests can no longer regenerate

Environmental Science Alert

Sea-level Rise in the Indian Ocean Differs by Region and Low-lying Pacific Reef Islands can Grow or Shrink in Size Depending on Conditions

Two new reports get more specific about sea-level rise: regional differences in sea-level rise in the Indian Ocean could exacerbate monsoons in Bangladesh and India but increase drought in the western equatorial Indian Ocean; and despite sea-level rise, atoll islands can either increase or decrease in size as island boundaries adjust dynamically in response to many conditions

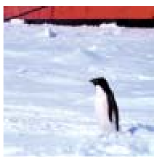
Near Real-Time Environmental Event Alert

Huge Iceberg Breaks off Greenland's Petermann Glacier

Satellite images capture the severing of a 251-km^2 chunk of ice four times the size of Manhattan Island from the Petermann Glacier 1 000 km south of the North Pole

Did You Know?

In 2007, arctic sea ice reached its lowest extent on record (NASA, 2009).



Environmental Hotspot Alert

Thematic Focus: Resource Efficiency and Ecosystem Management

Amazonian Deforestation Slowing but May Already be at a Tipping Point Mato Grosso, Brazil

Why is this issue important?

At the beginning of the 20th century, roughly 80 per cent of the 5 million km^2 “Legal Amazon” region of Brazil was forested (Kirby and others 2006). Highways built in the 1950s and 1960s, along with government incentives for colonization and development, created a boom in the conversion of

Figure 1: Roads cut lines through the dense green forest in this 1984-1985 satellite image mosaic and farms begin to cut large and small rectangles into the landscape.

forests to cattle ranching and farming (Kirby and others 2006). Much of this change occurred along an arc at the southern edge of the Amazon Basin where the newly built roads facilitated access to the forest and connected the region to markets outside the forest. Three states along this arc have accounted for the vast majority of deforestation—Para, Rondônia and Mato Grosso. Mato Grosso alone lost 56 277 km^2 of forest from 2001 to 2009 (INPE 2010)—an

The border between forest and agriculture in Mato Grosso.

Figure 2: By June of 2010 the light coloured patchwork of farms had spread out from the roads to cover the whole landscape.

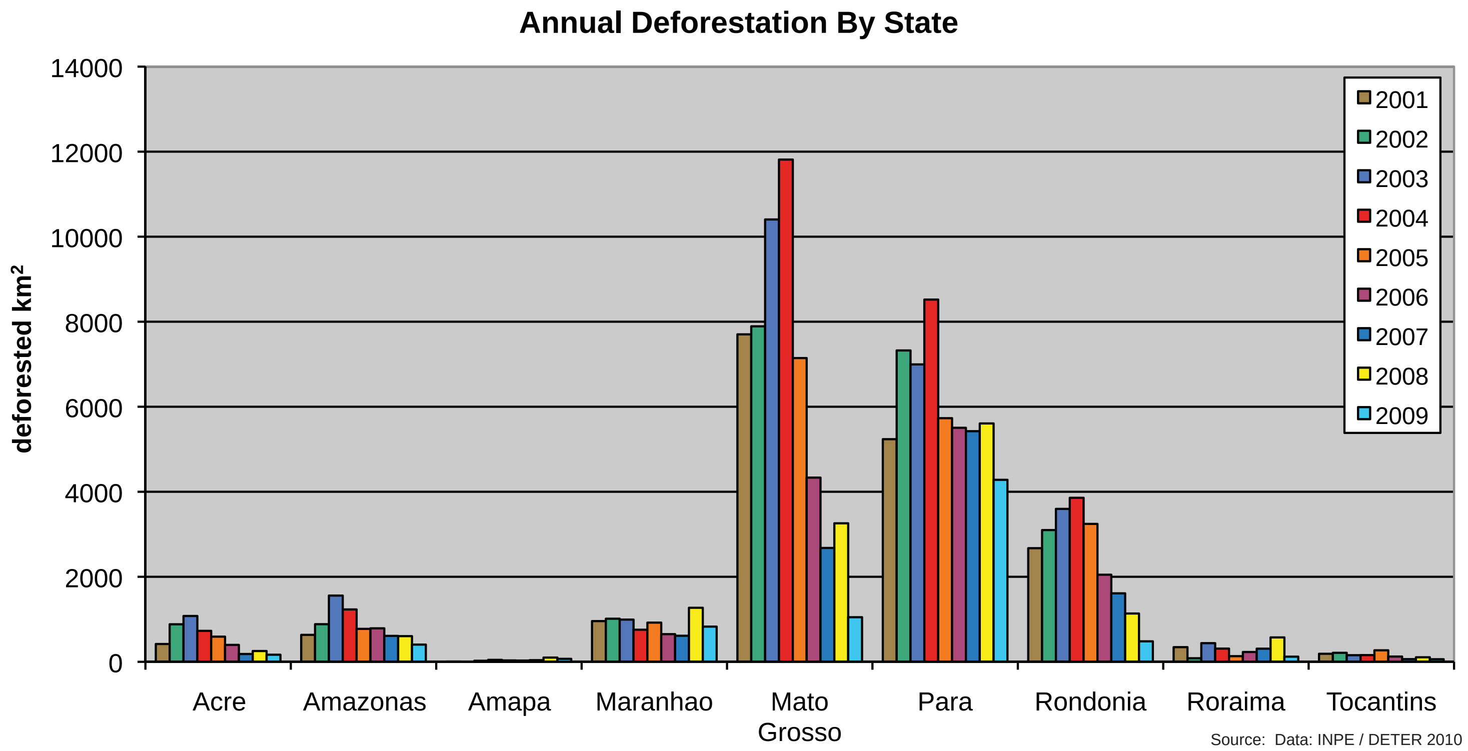


Figure 3: Deforestation in Brazil's northern states generally peaked around 2004, however rates still remain high, particularly in the state of Para.

area the size of Croatia deforested in just nine years (Figure 3).

What are the findings and implications?

This deforestation has been documented year-by-year in remote sensing data since the 1970s. The 1984/1985 image (Figure 1) shows a south-west to north-east path cut through the forest in an area of north-central Mato Grosso where highway BR-163 was built in 1973, and another highway branching to the northwest off BR-163.

By 2010 (Figure 2), the clearing that occurred only along roads in the mid-1980s had spread throughout the entire area leaving only patches of forest. Until recently, more than half of Highway BR-163 remained unpaved, however the Brazilian government has been moving forward with its plans to pave the remainder, in part to facilitate the transport of soybeans to shipping points on the Amazon (Fearnside 2007).

Deforestation peaked in around 2004 in Para, Rondonia and Mato Grosso (see Figure 3 above) and has declined in most years since; by 2009, it had dropped to about 40 per cent of the average forest loss of the last two decades (INPE 2010, Butler 2006). Recent research that models environmental feedbacks from deforestation, however, suggests that Mato Grosso may be reaching a tipping point at which forest loss will cause precipitation and soil-fertility to decline to the point that secondary forests would not be able to regenerate (Fearnside and others 2009).

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Sea-level Rise in the Indian Ocean Differs by Region and Low-lying Pacific Reef Islands can Grow or Shrink in Size Depending on Conditions

Why is this issue important?

Over the past few decades, sea levels worldwide have risen because of three primary phenomena related to climate change: the expansion of warming oceans, the input of fresh water from melting ice sheets and the loss of ice mass from Greenland and Antarctica (see the Near Real-Time Environmental Event Alert on page 7) (Climate Institute 2010). Rising seas threaten millions of people who live in densely populated coastal areas and low-lying islands, so it is critical for risk management purposes to estimate and prepare for the impacts of future sea-level rise and to be aware of regional differences.

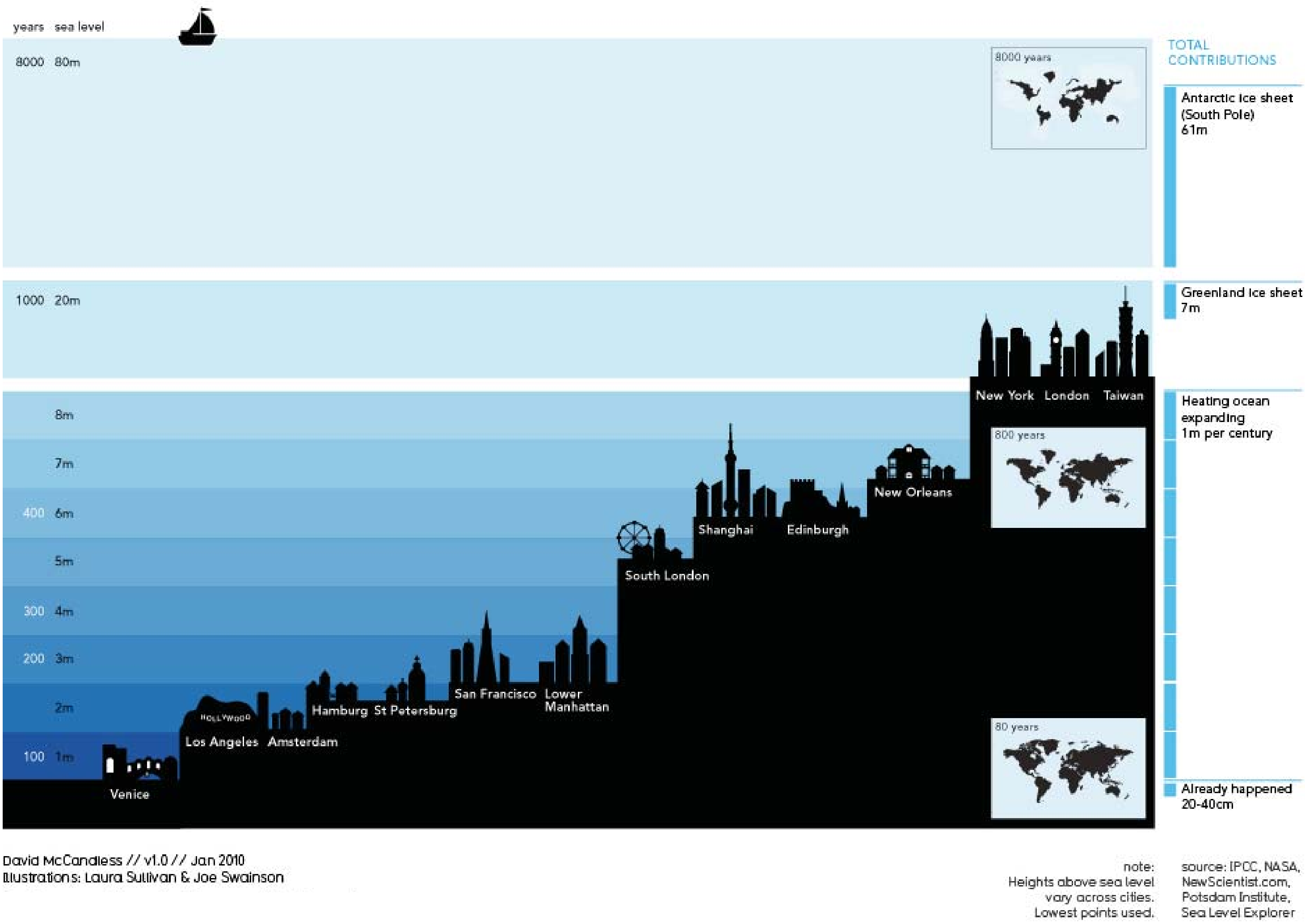
Detailed sea-level records provide testimony of sea-level rise over the past two decades, but shoreline monitoring and the detailed study of changes in island morphology are lacking. Given the international concern for the stability of small islands, it is important to complement sea-level records with quantified measures of reef-island changes at the same temporal scale to better inform the management of island landscapes in the face of climate change.

What are the findings and implications?

A new study (Han and others 2010) that combined ground and satellite observations of Indian Ocean sea levels with simulated models of climate change has identified a clear spatial pattern in sea-level rise since the 1960s. The researchers found increased sea levels in some areas of the Indian Ocean, but substantial declines in southern tropical parts.

The Indian Ocean is the world's third-largest ocean and accounts for about 20 per cent of the Earth's surface water. Within this ocean is an enormous pool of warm water extending from Africa's east coast to the Pacific International Date line. Over the past 50 years,

Figure 1: Which cities will flood when?



Source: InformationIsBeautiful.net

this Indo-Pacific warm pool has warmed by about 0.5 °C. Along the northern Indian Ocean coast, sea levels have risen by an average of 12.7 mm a decade. The Bay of Bengal, the Arabian Sea, Sri Lanka, Sumatra and Java are particularly affected.

These changes in regional ocean patterns and sea levels could exacerbate flooding due to monsoons in Bangladesh and India and lead to increased rainfall in the eastern tropical Indian Ocean and drought in the western equatorial Indian Ocean. Climate-change impacts on the Indo-Pacific warm pool could mean that islands in the middle of the Indian Ocean would experience significantly higher sea-level increases than the global average. As a result, some coasts and islands in the Indian Ocean and their populations will suffer from increased environmental stress.

Another study related to sea-level rise (Webb and Kench 2010) appears to contradict the general anticipation that the impacts of climate change will eventually make low-lying reef islands unable to support human occupation. It uses aerial and satellite images taken over the past 60 years, a time during which there is evidence that sea levels have risen, to compare the landform dynamics of 27 atoll islands in the central Pacific Ocean. The study found that as a whole, instead of declining, the islands grew in land area by a total of 63 ha or seven per cent.

The research findings show that although sea level in the central Pacific Ocean rose by about 2.0 mm/yr over the study period and that all 27 islands changed physically during that time, there is considerable variation in the amount and style of change between and among the islands, with an overall net increase in land area; 86 per cent of the islands remained relatively stable or their outline or shape increased in size. Twelve of the 27 islands increased in size by more than three per cent but only four islands reduced in area by more than three per cent.

In addition to these net changes in area, the way the islands are positioned on the reef platform also changed. In 65 per cent of cases, the islands moved closer to their lagoons, for example. The study's authors conclude that islands are a constant feature of atoll reefs and despite sea-level rise, can increase or decrease in size; that island boundaries adjust dynamically in response to many conditions; and that erosion in some areas may be offset by increases in others. Finally, since the magnitude and style of change varies among islands, island nations will need to take note of their own particular type and rate of change when considering how to adapt to the impacts of a changing climate.

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Near Real-Time Environmental Event Alert

Thematic Focus: Climate Change and Ecosystem Management

Huge Iceberg Breaks off Greenland's Petermann Glacier

Why is this issue important?

Glaciers are naturally dynamic, slowly changing in shape and size as they move. When a glacier enters the sea, new icebergs form as pieces break off, or calve, from the glacier. How much calving occurs depends on the glacier's growth rate, determined by the amount of new snow and the speed at which it moves and melts. Studies on changes in glacier calving are important pieces of information in helping determine the impacts of climate change.

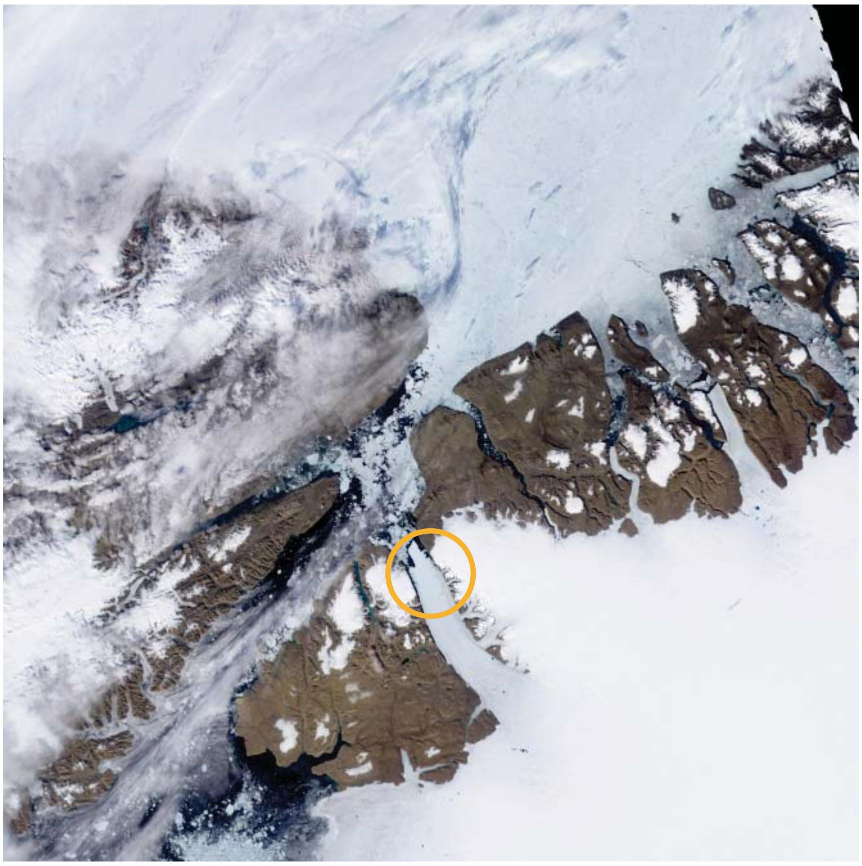

Figure 1: The calving of a giant iceberg illustrated by satellite imagery from 28 July (left) and 5 August 2010 (bottom). The iceberg is expected to drift into the Nares Strait either blocking it or breaking up into smaller pieces (NASA 2010).

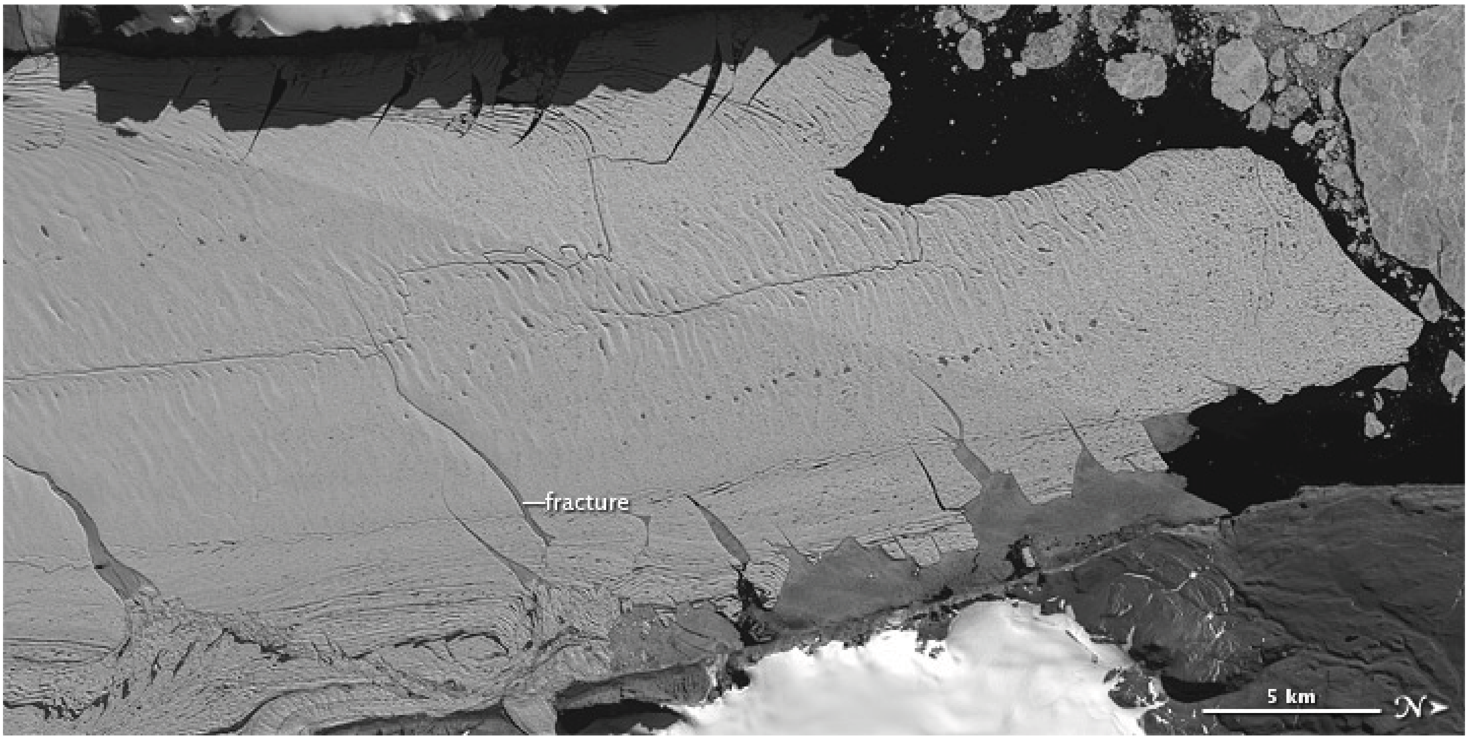

Figure 2: Large fractures in the glacier tongue as observed on 22 July 2010 (Source: NASA 2010).

What are the findings and implications?

On 5 August 2010, researchers from the University of Delaware, USA, reported that the Petermann Glacier along Greenland's northwestern coast had lost about a quarter of its 70-km long floating tongue (Figure 1). Petermann Glacier is only 1 000 km south of the North Pole and is one of Greenland's two largest remaining glaciers that have shelves or tongues extending into the Arctic sea. The glacier's new calf is 251 km^2, or about four times the size of Manhattan Island.

Fractures, which relieve pressure on ice tongues and allow them to stretch, often precede iceberg calvings. Such cracks had been observed in the Petermann glacier (see Figure 2), so the break-up was anticipated.

The new iceberg is expected to float south in the Nares Strait, break up and eventually reach the Atlantic in about two years. The calving of an iceberg this size was last observed in 1962, although there has been a lot of glacier calving in the region over the past decade, which coincides with the warmest decadal average global temperature. More of Greenland's ice sheet is expected to melt as temperatures in the Arctic rise. Researchers estimate that Greenland contributes about 15 per cent of current sea-level increases of 32 mm per decade. Should the entire Greenland ice sheet melt (which would take several centuries at current and predicted rates of global warming), sea-level would rise about seven metres (Climate Central 2010).

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