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Did You Know?

Every day, the Earth is bombarded with more than 100 tonnes of dust and sand-sized particles (NASA 2009).

Environmental Hotspot Alert

Thematic Focus: Resource Efficiency, Ecosystem Management, and Climate Change

Only Scraps of the South American Atlantic Forest Remain Eastern Paraguay

Why is this issue important?

Prior to the mid-20th century, an extensive subtropical rain forest covered much of the Brazilian coastal plain, eastern Paraguay and part of northern Argentina. The forest supported over 20 000 plant species, many of them endemic, as well as a diverse array of fauna. Beginning with selective logging prior to the 1940s, deforestation accelerated through the 1970s,

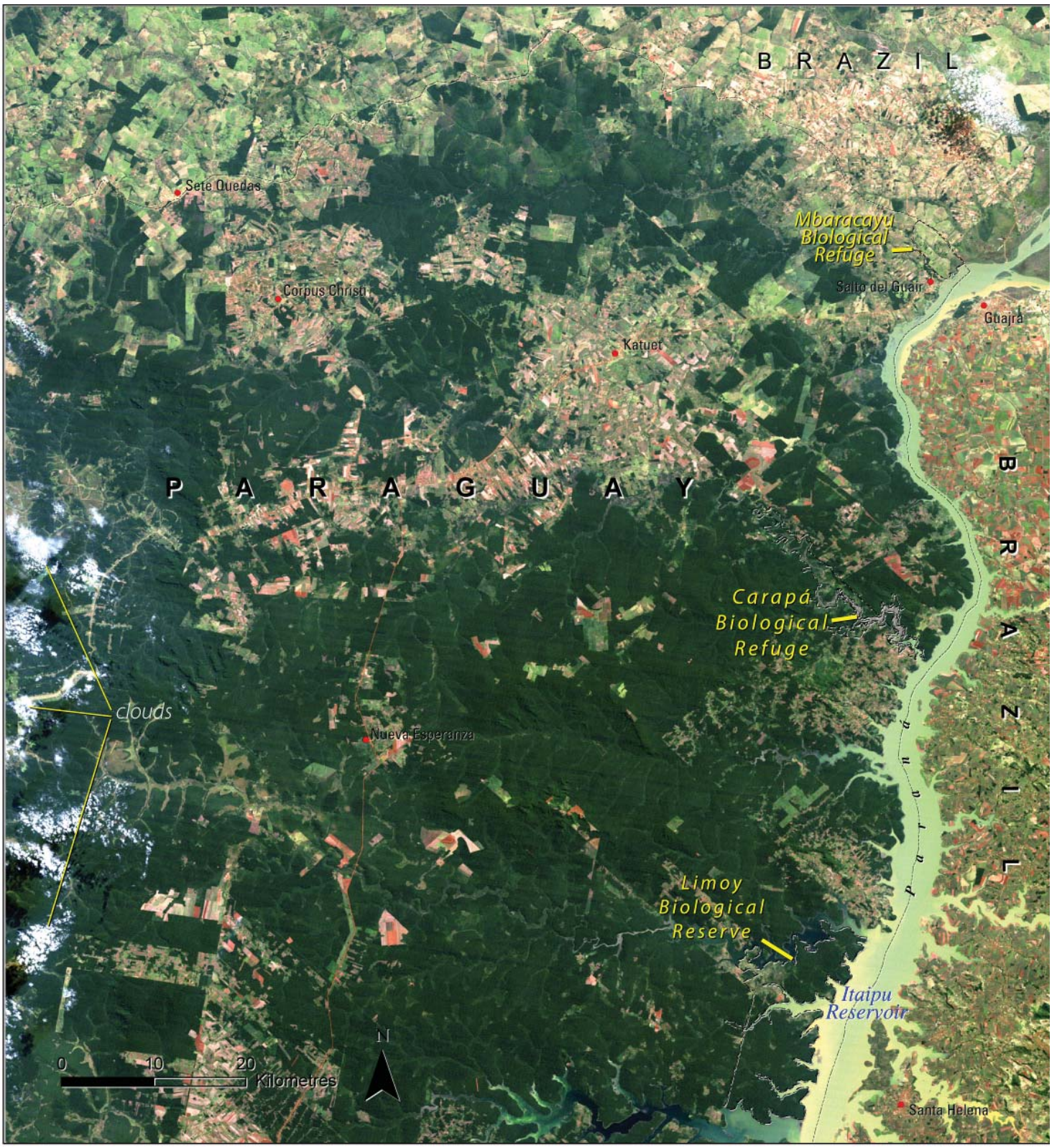
Figure 1: A 1970s Landsat satellite image shows dense green forest on the Paraguayan side of the border, farms on the Brazilian side.

leaving less than 10 per cent of the original forest by early in the 21st century (Huang and others 2007, Huang and others 2009, Wayant and others 2010). Where these forests used to cover eastern Paraguay, farmland now dominates the landscape. Most of the forest clearance has been attributed to the advent of larger mechanized farms growing soy, cotton and sugar (Huang and others 2009). These remaining forests are of profound global importance due to both the biodiversity they contain and their potential to sequester carbon from entering the atmosphere.

What are the findings and implications?

The almost total conversion of eastern Paraguay's subtropical rain forest to agriculture and cattle grazing can be seen in the satellite images spanning the period between 1972 and 2010. The 1970s-era mosaic (Figure 1) shows largely intact forest on the Paraguayan side, in contrast to Brazilian farms just across the border. By the mid-1980s (Figure 2), large areas had been converted to farms but forest still dominated on the Paraguayan side. By 2010

Figure 2: The 1985 Landsat satellite image shows the green Paraguayan forest giving way to farm fields.



(Figure 3), the remaining forest can be seen as dark-green patches scattered among the large and small farm fields.

It is estimated that 40 per cent of Paraguay's subtropical rain forest was lost between 1989 and 2000. This is slightly less than the loss in Brazil and Argentina, however, leaving an estimated one-quarter of the original forest still largely intact in Paraguay. A handful of national parks, biological reserves, biological refuges and national monuments provide some protection for these remnants, although significant losses have been measured even within protected areas (Huang and others 2007).

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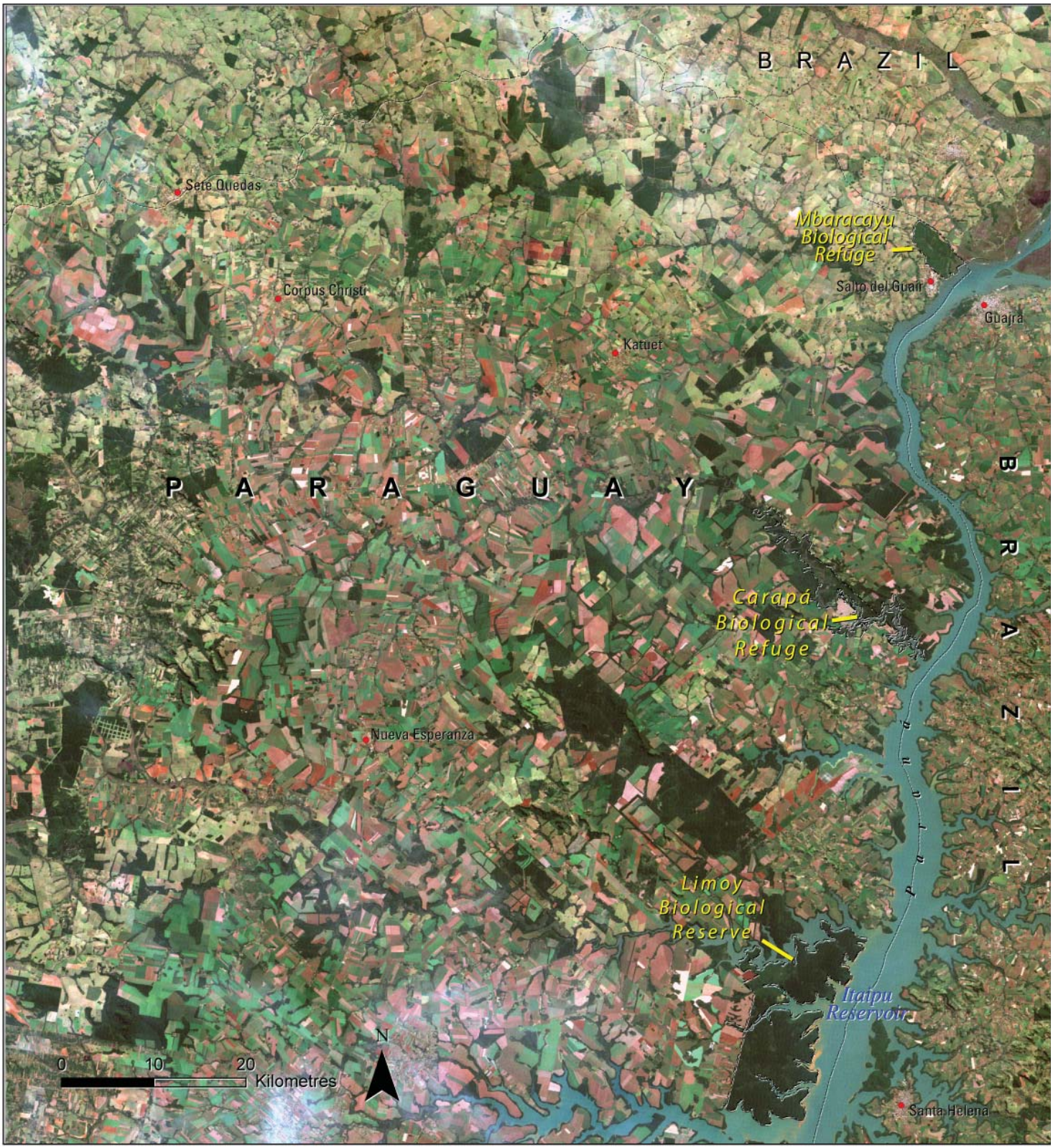
Figure 3: A 2010 Landsat satellite image shows only a few small patches of dark-green forest remaining, mostly within protected areas.



Environmental Science Alert

Thematic Focus: Ecosystem Management and Climate Change

Plant Growth Declined Over the Past Decade

Why is this issue important?

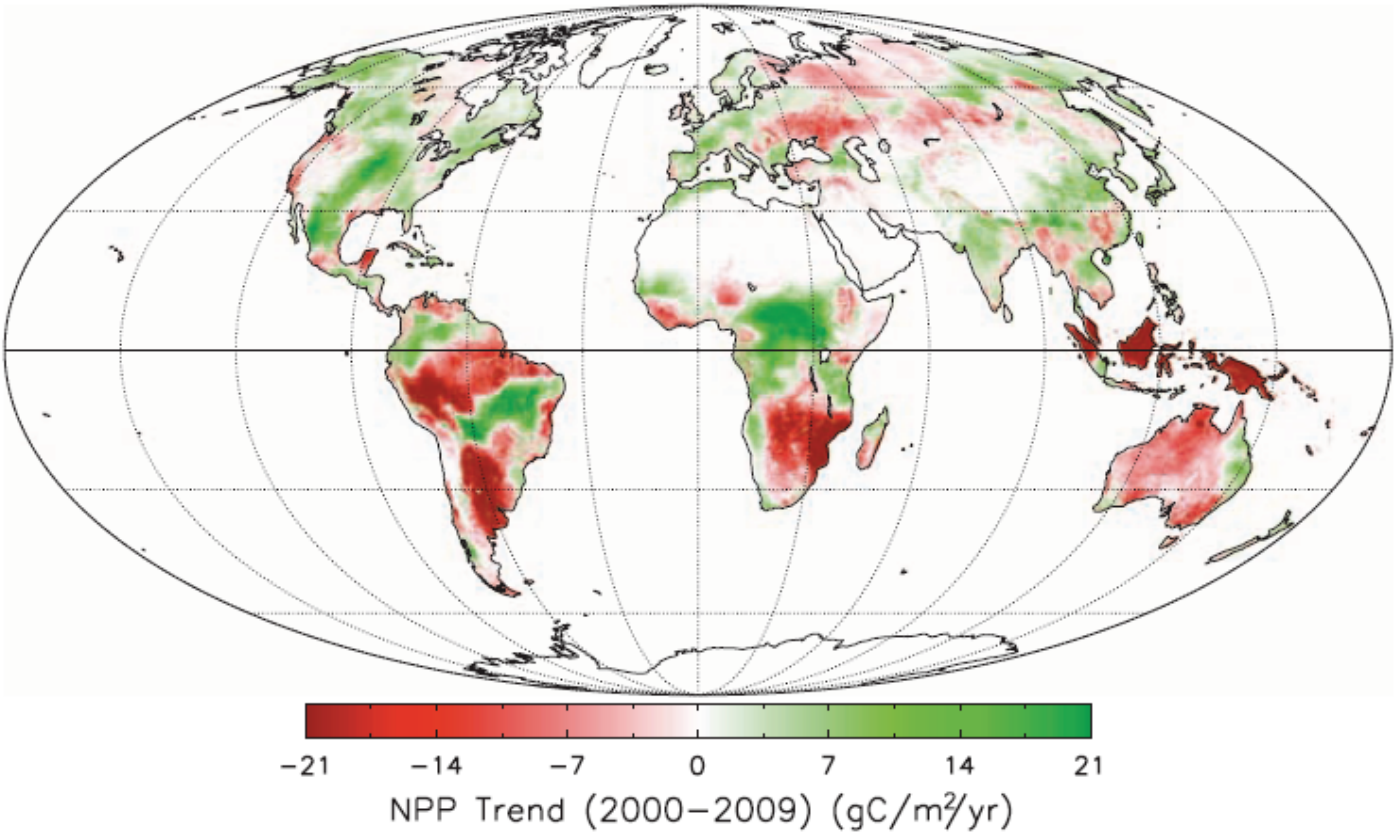
Calculating Net Primary Production (NPP) is the first step in quantifying the amount of carbon plants fix from the atmosphere and accumulate as biomass. NPP is an important component of the global carbon cycle, but it is also useful in estimating environmental change, such as desertification, deforestation, and disturbances such as fire and insect outbreaks; assessing the impacts of pollution and climate change; and evaluating the status of ecosystems and their services, including habitat and wildlife condition and the size of ecological footprints. NPP is also a very useful measure to inform land management decisions and to estimate renewable natural resources.

What are the findings and implications?

In a paper published on 20 August 2010 in *Science*, researchers report that contrary to expectations, terrestrial biomass production has declined over the last decade (2000-2009) (Zhao and Running 2010). In 2003, studies had shown that terrestrial biomass

production had increased in line with rising global average temperatures (Nemani and others 2003). Satellite data estimating the amount of carbon stored in vegetation between 1982 and 1999 had been used to monitor changes in biomass production. The long-term correlation with average surface temperatures had led to the conclusion that a warming climate generally enhances biomass production, with positive implications for food availability.

Figure 1: Global distribution of change in carbon-stored biomass between 2000 and 2009 as calculated by Zhao and Running (2010). Red areas represent decreased production; in green areas, NPP has increased; and white areas have not changed significantly.



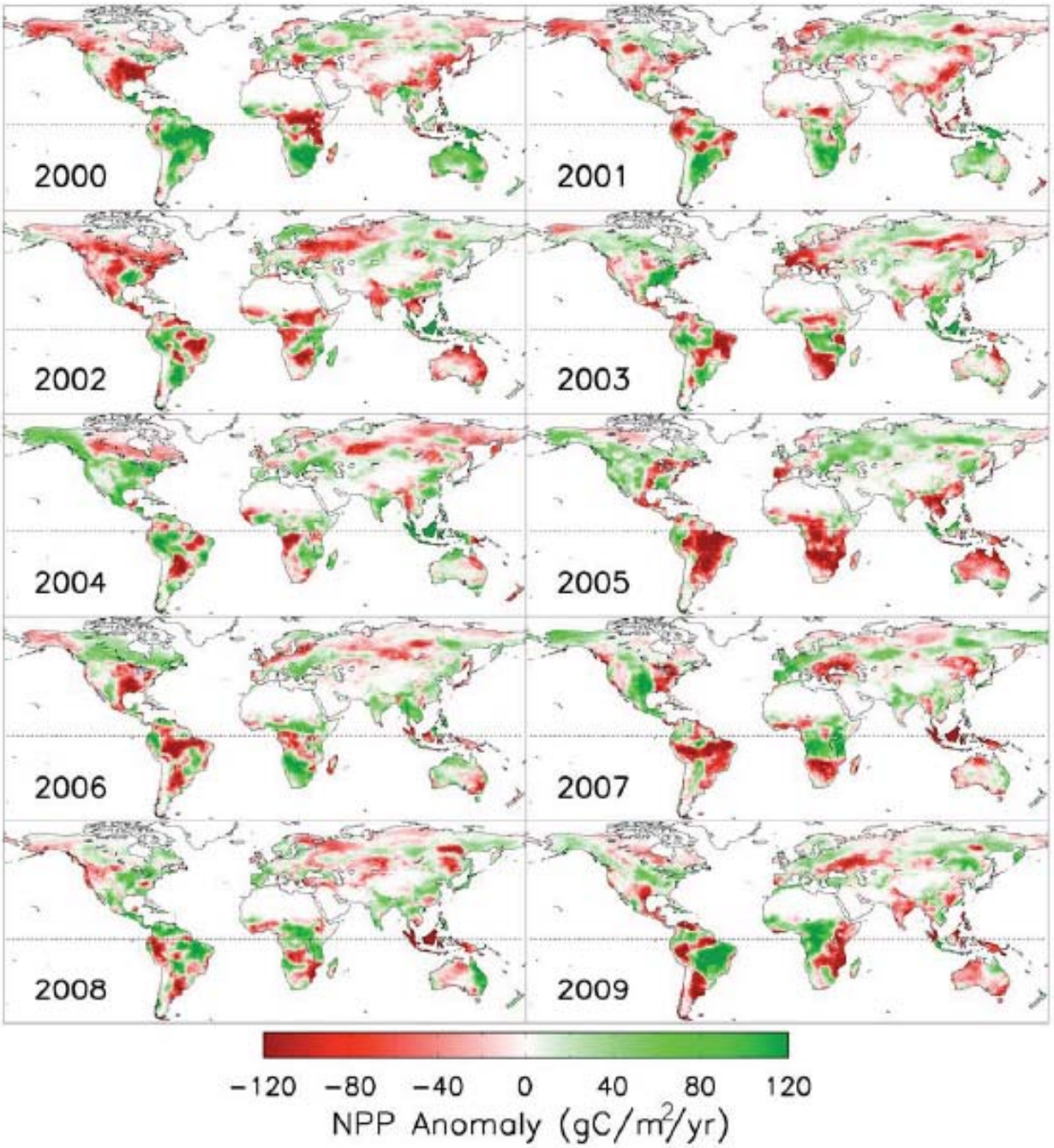


Figure 2: Annual anomalies in carbon stored in biomass as calculated by Zhao and Running (2010). Note the droughts in parts of North America and China in 2000 and in North America and Australia in 2002; a heat wave in Europe in 2003; and severe droughts in the Amazon, Africa and Australia in 2005.

The more recent report, however, has found evidence from similar satellite data (MODIS Terra) from 2000 to 2009 that terrestrial biomass production has decreased even though the decade has been the warmest since records began. The main reason for the calculated reduction is thought to be a series of large-scale droughts that occurred in various regions over the decade. Droughts in tropical regions in particular have affected the net change, as most biomass and thus carbon is stored in tropical vegetation such as rain forests (see Figure 2 for annual anomalies and specific drought events).

The implications of this reverse effect are significant considering forecasts of even warmer years in the future—not only will this decrease crop yields and associated food security (in case of more frequent droughts), but it also means less carbon than usual will be stored in terrestrial biomass, further perpetuating the rise in atmospheric CO_2. A continued decline in NPP would not only weaken the terrestrial carbon sink, but it would also intensify future competition between the demand for food and proposed biofuel production. The planet has a “finite plant-growth potential” and decreasing NPP would set a stricter bound on that potential, meaning that society will have to make difficult decisions about how to use the given potential for plant growth.

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Near Real-Time Environmental Event Alert

Thematic Focus: Disasters and Conflicts, Harmful Substances and Hazardous Waste, and Ecosystem Management

The Gulf of Mexico Oil Spill: the World's Largest Accidental Offshore Oil Spill

Why is this issue important?

The Gulf of Mexico, which covers about 1 554 000 km^2, is the world's ninth-largest body of water and has been called the "Mediterranean of the Americas." More than 60 per cent of the water drained from 33 major river systems and 207 estuaries in the United States enters the Gulf, which receives additional freshwater inputs from the Yucatan Peninsula and Cuba. Some of the world's most productive fisheries operate in the Gulf of Mexico: in 2008, the commercial fish and shellfish harvest was estimated at approximately 590 million kilograms and was valued at US$661 million. The Gulf is extremely important to regional economies. In 2006, it produced 470 million barrels of oil and about 82 million m^3 of natural gas. Its offshore operations produce a quarter of the U.S.'s domestic natural gas and one-eighth of its oil and provide jobs for over 55 000 U.S. workers. In addition, the region supports a US$20 billion tourist industry. The Gulf's wetlands, which comprise about half of the country's

total wetland area, and its other marine and estuary ecosystems are also very important habitats for both wildlife and commercial species (US EPA 2010a).

On 20 April 2010, a huge fire engulfed a Deepwater Horizon petroleum-drilling rig that had exploded in the Gulf of Mexico, killing 11 platform workers and injuring

Figure 1: Approximate oil location on 22 April 2010. Approximation based on overflight information. The oil slick was confined to the immediate area surrounding the location of the exploded rig.

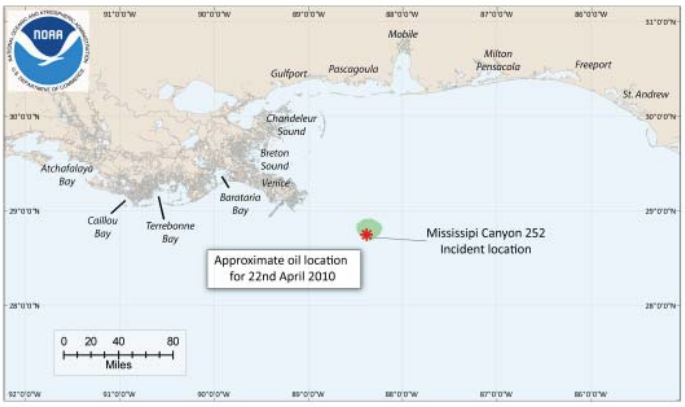


Figure 2: Nearshore Surface Oil Forecast Deepwater Horizon MC252 based on the National Weather Service (NWS) spot forecast from 31 May PM.

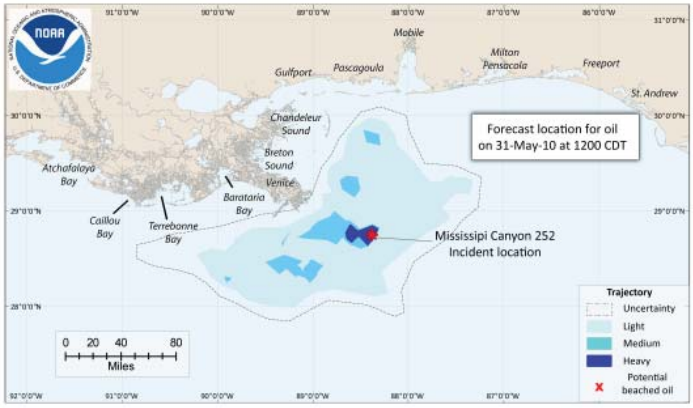


Figure 3: Nearshore Surface Oil Forecast Deepwater Horizon MC252 based on the National Weather Service (NWS) spot forecast from 30 June PM.

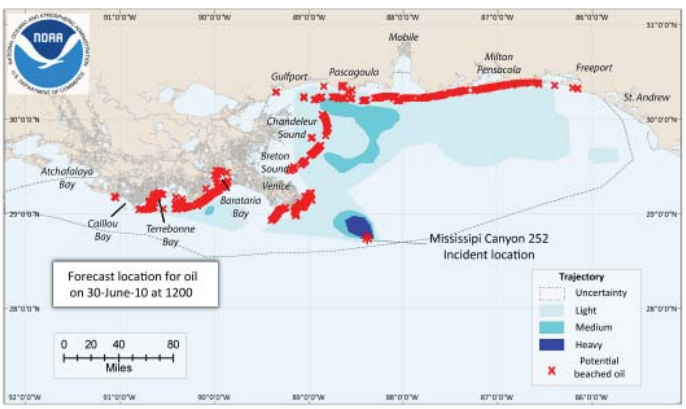
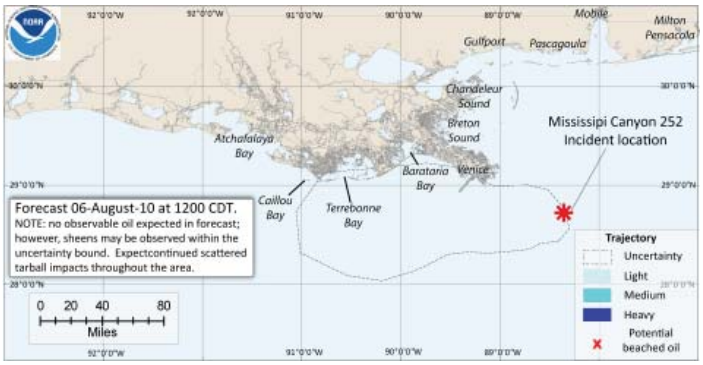


Figure 4: Nearshore Surface Oil Forecast Deepwater Horizon MC252 based on the National Weather Service (NWS) spot forecast from 5 August PM. This map shows no observed oil on the water surface.



17 others. After burning for hours, the rig sank on 22 April, resulting in the spread of a large oil slick from the location of the former rig. Over a period of 100 days, attempts were made to stop the oil's gushing and to control its spread. In early June, the U.S. government imposed fishing restrictions covering 37 per cent of U.S. federal waters in the Gulf. Finally, on 15 July, British Petroleum (BP) succeeded in fitting a tight sealing containment cap, which stemmed the leak (TRF 2010). U.S. government data show that 4.9 million barrels of oil leaked before the well was capped.

What are the findings and implications?

The maps on the previous page (all modified from the NOAA Deepwater Horizon 24Hr Offshore Maps) show a time-series of the oil's spread over the Gulf waters between 22 April and 6 August. They illustrate the oil's trajectory from the incident's location towards land, aided by wind and sea currents. The maps were produced by using several models of water currents (NOAA Gulf of Mexico, West Florida Shelf/USF, TGLO/TAMU, NAVO/NRL) and high-frequency radar measurements.

The media has called the event the world's largest accidental offshore oil spill (Chediak 2010, New York Times 2010). In mid-August, about 1 086 km of Gulf Coast shoreline had been affected and approximately 136 000 km^2 of Gulf of Mexico federal waters were still closed to fishing. An interagency report estimated that burning, skimming and direct recovery removed 25 per cent of the oil, another 25 per cent evaporated or dissolved, 24 per cent was dispersed and 26 per cent is either on or just below the surface, has washed ashore or is buried in sand and sediments (Deepwater Horizon 2010).

The oil spill had significant impacts on wetland and marine species that became covered in oil when they encountered the oil slick, including gannets, brown pelicans and other shore birds. By 1 July, response teams had collected 594 stranded sea turtles, of which 441 had already died (CBD 2010).

According to the United States Environmental Protection Agency (US EPAa), there were low levels of odour-causing pollutants associated with oil in sampled air and surface water samples did not reveal elevated levels of chemicals usually found in oil (water samples collected between 9 and 10 June and 6 and 11 August 2010 along the Gulf Coast). However, sediment samples collected between 8 and 10 June and 2 and 9 August 2010 found nickel that exceeded chronic aquatic life benchmarks (US EPA 2010b). Nevertheless, the Gulf's vegetation and wildlife is already recovering (NOLA 2010).

The implications of the oil spill include future decisions about large-scale oil drilling versus investments in energy efficiency and renewable energy. The global community has learned that future oil and gas developments must be subjected to stringent risk and environmental impact assessments.

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