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New Research Indicates Amount of Frozen Organic Carbon Locked Away in Permafrost Regions is Double Previous Estimates

September 12, 2008

In a paper published in the latest edition of Bioscience, an international team of scientists says whereas some of the CO₂ produced as a result of decomposition of previously frozen vegetation would be absorbed by increased, global warming-induced plant growth, it is likely the net effect would be a significant net increase in atmospheric CO₂.

Involving collaboration between scientists from Australia, Russia, the US, the UK, Canada and Europe the three-year study concluded that accounting for carbon stored deep in the permafrost more than doubles – to more than 1500 billion tonnes – previous estimates of the world's high-latitude carbon inventory.

"This is equivalent to twice the current amount of CO₂ in the world's atmosphere," says co-author, CSIRO's Dr Pep Canadell, from The Centre for Australian Weather and Climate Research – a partnership between CSIRO the Australian Bureau of Meteorology.

"With temperatures in the higher latitudes estimated to rise by as much as eight degrees by the end of this century, the world could experience a major melt of large tracts of permafrost in Canada, Russia, Alaska, Norway, Sweden, Finland and Greenland," he says.

"However, accurately predicting the magnitude and effect of thawing permafrost on the world's climate is difficult for several reasons.

"While global carbon models may include simple permafrost dynamics they do not adequately represent the broader consequences, such as the decomposition of organic matter in thawing permafrost and the transformation of landscapes."

Dr Canadell says that despite such limitations, scientists now know that even the release of a small fraction of this vast frozen reservoir of carbon would significantly accelerate climate change.

"At current rates of warming in the higher latitudes, the evidence indicates that this is likely to happen," he

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Friday, September 12, 2008

Permafrost find adds to climate calamity

- **Adam Morton**
- WA Today, September 12, 2008
- <http://www.watoday.com.au/national/permafrost-find-adds-to-climate-calamity-20080912-4fie.html>

THE blanket of permafrost covering a fifth of the world's land mass traps twice as much greenhouse gas as previously thought — and is therefore much more likely to trigger rapid climate change as it melts, research says.

A paper published in the journal *Bioscience* estimates that more than 1500 billion tonnes of carbon dioxide and methane is locked in frozen vegetation at high latitudes. This is more than double the amount of greenhouse gas now in the atmosphere.

CSIRO atmospheric scientist Pep Canadell — part of an international team of 19 scientists that worked on the paper — said while it was not possible to accurately predict how much carbon would escape from the permafrost as it warmed, the release of even a fraction would accelerate climate change dramatically.

"With temperatures in the higher latitude estimated to rise by as much as 8 degrees by the end of this century, the world could experience a major melt of large tracts of permafrost in Canada, Russia, Alaska, Norway, Sweden, Finland and Greenland," he said.

The *Bioscience* paper is a first on two fronts: its researchers accessed long-term Russian data sets that had never been properly analysed, and dug much deeper cores into frozen regions than previous studies.

More than half the world's permafrost — defined as soil that has remained below zero degrees for at least two years — is in the former Soviet Union. It ranges in thickness from 1450

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Frozen carbon twice previous estimates

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The World Today - Friday, 12 September, 2008 12:30:00

Reporter: Simon Lauder

ELEANOR HALL: An international team of scientists has concluded a three year study on the potential for greenhouse gases to be released from previously frozen regions of the Earth and has found that it is far more dangerous than previously thought.

Scientists from Australia, Russia, the US, the UK, Canada and Europe say if thawing occurs, previously frozen vegetation could release twice as much CO₂ and methane as scientists have been predicting.

The findings have been published in the latest edition of the journal 'Bioscience'.

Dr Pep Canadell from the CSIRO is one of the report's authors and he has been speaking to Simon Lauder.

PEP CANADELL: What's really new and I think that is most surprising is the fact that we have gone through what we call soil profiles and sediment profiles of organic matter across Canada, Scandinavia, Russia and basically all the countries where they have a significant permafrost in the Northern Hemisphere, and found that with all this new data, that we have almost double the amount of the carbon content of permafrost when compared to the estimates we have been using until recently to do our projections of, you know, climate change and potential carbon releases into the future.

SIMON LAUDER: In fact, you say there's 1,500 billion tonnes of the stuff?

PEP CANADELL: Yes, correct. And before, even the IPCC (Intergovernmental Panel on Climate Change) was still considering that the amount of carbon locked in permafrost was around anywhere between 400 and 800 billion tonnes, so we're talking about here more than double.

SIMON LAUDER: There's no way of knowing whether any of this permafrost will actually thaw, is there?

PEP CANADELL: The permafrost is actually already thawing now, it has been thawing for the last few decades and it is closely linked to the human induced warming of the high latitudes, a layer of frozen ground keeps going deep and deep into the soil, and that's very well measured.

Now, what's more difficult to really understand is what's going to happen when that soil has been melted, how much of that carbon is going to be decomposed and how much is going to be released into the atmosphere, and therefore impacting the climate change.

So these are the big questions, and we don't have an answer yet for that, either.

SIMON LAUDER: What would it mean if even a small fraction of the vast frozen reservoir of carbon were to be released?

PEP CANADELL: Well, we have done our calculations ourselves, and if the scenario like 10 per cent was going to melt, and so what we come up is that at the end of this century, we have about 80-90 parts per million more, and this is like almost 10 to 15 per cent more carbon in the atmosphere than we would have otherwise, you know had not the permafrost melt. That's a substantial additional to climate change.

SIMON LAUDER: So there's so much carbon and methane stored in permafrost, that if any of it melts, you're saying it will rapidly accelerate climate change?

PEP CANADELL: There is no doubt about that, the big doubt is how much is going to be released.

SIMON LAUDER: Obviously it's a positive feedback scenario, though?

PEP CANADELL: It is always a positive feedback, it's whether how much is going to be released and whether it's going to be released as methane largely, which is a very powerful greenhouse gas, or carbon dioxide, which is less powerful but you know huge quantities.

So these things are big concerns, and our study does not offer any new insights on that.

ELEANOR HALL: Dr Pep Canadell from the CSIRO, speaking to Simon Lauder.

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Melting permafrost may hasten global warming

Deborah Smith Science Editor

September 13, 2008

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TWICE as much carbon is locked away in the frozen soils of the earth's permafrost regions as had been thought, raising the concern that global warming will accelerate faster than expected once the soils start to thaw.

A three-year study by an international team of researchers including Pep Canadell of the CSIRO produced the new estimate, based on cores up to three metres deep taken from permafrost regions, particularly across Russia.

Dr Canadell said temperatures near the poles were predicted to rise by as much as 8 degrees by the end of the century. "The world could experience a major melt of large tracts of permafrost in Canada, Russia, Alaska, Norway, Sweden, Finland and Greenland."

Frozen organic carbon locked in the soil would decompose, releasing greenhouse gases such as carbon dioxide and methane.

Scientists had estimated there were between 400 billion and 800 billion tonnes of carbon locked in these regions, but the study, published in the journal *BioScience*, has increased this to more than 1500 billion tonnes.

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Permafrost find adds to climate calamity

Adam Morton

September 13, 2008

THE blanket of permafrost covering a fifth of the world's land mass traps twice as much greenhouse gas as previously thought — and is therefore much more likely to trigger rapid climate change as it melts, research says.

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CSIRO atmospheric scientist Pep Canadell — part of an international team of 19 scientists that worked on the paper — said while it was not possible to accurately predict how much carbon would escape from the permafrost as it warmed, the release of even a fraction would accelerate climate change dramatically.

"With temperatures in the higher latitude estimated to rise by as much as 8 degrees by the end of this century, the world could experience a major melt of large tracts of permafrost in Canada, Russia, Alaska, Norway, Sweden, Finland and Greenland," he said.

The *Bioscience* paper is a first on two fronts: its researchers accessed long-term Russian data sets that had never been

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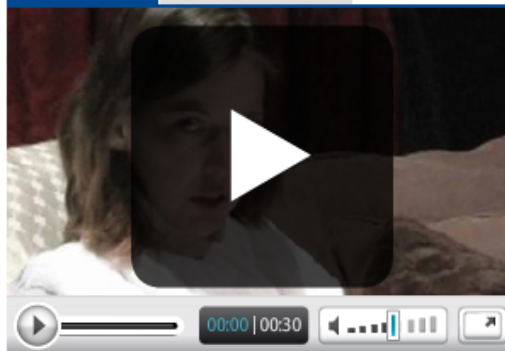
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Permafrost carbon estimates doubled

September 12, 2008 - 7:58PM



A new study by a team of international scientists has revealed the amount of carbon frozen in the world's permafrost is double what was previously thought.

The three-year study concluded that the amount of carbon locked up in the world's permafrost is at least 1,500 billion tonnes more than double previous estimates and the equivalent of twice the current amount of Co2 in the world's atmosphere.

Permafrost is frozen soil found at high latitudes, close to the north or south poles, and contains the remains of plants and animals which due to the extreme cold do not decompose, trapping carbon in the soil.

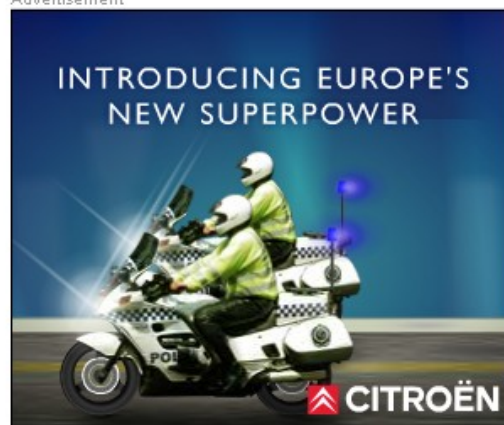
This is the most accurate assessment yet of the amount of carbon contained in worldwide permafrost but the actual amount may well be higher, says CSIRO scientist and study team member Dr Pep Canadell.

"We are now in the ballpark of what probably is there, there is still a big issue and that is the depth, our database goes down to three metres for much of the permafrost ... but we know that the depths can be much greater," he said.

The level of carbon contained in the world's permafrost is of particular significance to climate change as once the carbon it contains begins to be released there is no way to stop it.

This could lead to a large amount of extra carbon dioxide and methane being released into the atmosphere and potentially speeding up warming, a process some climate scientists refer to as a tipping point, Dr Canadell says.

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Permafrost carbon content double the old estimates

Source: CSIRO, the Commonwealth Scientific and Industrial Research Organisation

Published Sep. 12, 2008

New research indicates that the amount of frozen organic carbon locked away in the world's permafrost regions – a major potential source of atmospheric carbon dioxide (CO₂) and methane (CH₄) – is double what has been previously estimated. In a paper published in the latest edition of Bioscience, an international team of scientists says whereas some of the CO₂ produced as a result of decomposition of previously frozen vegetation would be absorbed by increased, global warming-induced plant growth, it is likely the net effect would be a significant net increase in atmospheric CO₂.

Involving collaboration between scientists from Australia, Russia, the US, the UK, Canada and Europe the three-year study concluded that accounting for carbon stored deep in the permafrost more than doubles – to more than 1500 billion tonnes – previous estimates of the world's high-latitude carbon inventory.

"This is equivalent to twice the current amount of CO₂ in the world's atmosphere," says co-author, CSIRO's Dr Pep Canadell, from The Centre for Australian Weather and Climate Research – a partnership between CSIRO the Australian Bureau of Meteorology.

"With temperatures in the higher latitudes estimated to rise by as much as eight degrees by the end of this century, the world could experience a major melt of large tracts of permafrost in Canada, Russia, Alaska, Norway, Sweden, Finland and Greenland," he says.

"However, accurately predicting the magnitude and effect of thawing permafrost on the world's climate is difficult for several reasons.

"While global carbon models may include simple permafrost dynamics they do not adequately represent the broader consequences, such as the decomposition of organic matter in thawing permafrost and the transformation of landscapes."

Dr Canadell says that despite such limitations, scientists now know that even the release of a small fraction of this vast frozen reservoir of carbon would significantly accelerate climate change.

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Melting permafrost may hasten global warming

Source: Copyright 2008, [Sydney Morning Herald](#)

Date: September 13, 2008

Byline: Deborah Smith

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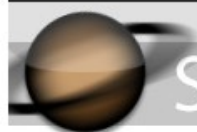
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Permafrost carbon estimates doubled

20:48 AEST Fri Sep 12 2008

By Samuel Cardwell

A new study by a team of international scientists has revealed the amount of carbon frozen in the world's permafrost is double what was previously thought.

The three-year study concluded that the amount of carbon locked up in the world's permafrost is at least 1,500 billion tonnes more than double previous estimates and the equivalent of twice the current amount of Co2 in the world's atmosphere.

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"We are now in the ballpark of what probably is there, there is still a big issue and that is the depth, our database goes down to three metres for much of the permafrost ... but we know that the depths can be much greater," he said.

The level of carbon contained in the world's permafrost is of particular significance to climate change as once the carbon it contains begins to be released there is no way to stop it.

This could lead to a large amount of extra carbon dioxide and methane being released into the atmosphere and potentially speeding up warming, a process some climate scientists refer to as a tipping point, Dr Canadell says.

"Technically, we call it the climate carbon feedback and permafrost is a beautiful one and we know that some of these processes can potentially be irreversible," he said.

"Irreversible doesn't mean that all the carbon is going to go into the atmosphere right away, but it means that

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Permafrost carbon content double the old estimates

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Frozen sediments (permafrost) in Eastern Siberia.
Photo by: Sergei Zimov

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Permafrost carbon content double the old estimates

Reference: 08/164

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12 September 2008

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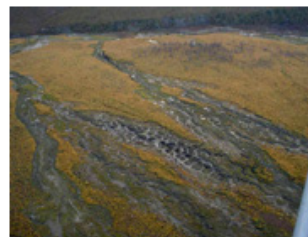
"With temperatures in the higher latitudes estimated to rise by as much as eight degrees by the end of this century, the world could experience a major melt of large tracts of permafrost in Canada, Russia, Alaska, Norway, Sweden, Finland and Greenland," he says.

"However, accurately predicting the magnitude and effect of thawing permafrost on the world's climate is difficult for several reasons.

"While global carbon models may include simple permafrost dynamics they do not adequately represent the broader consequences, such as the decomposition of organic matter in thawing permafrost and the transformation of landscapes."

Dr Canadell says that despite such limitations, scientists now know that even the release of a small fraction of this vast frozen reservoir of carbon would significantly accelerate climate change.

"At current rates of warming in the higher latitudes, the evidence indicates that



Frozen sediments (permafrost) in Eastern Siberia.

Photo by: Sergei Zimov

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FAST FACTS

- ▴ Involving collaboration between scientists from Australia, Russia, the US, the UK, Canada and Europe the three-year study concluded that accounting for carbon stored deep in the permafrost more than doubles – to more than 1500 billion tonnes – previous estimates of the world's high-latitude carbon inventory
- ▴ With temperatures in the higher latitudes estimated to rise by as much as eight degrees by the end of this century, the world could experience a major melt of large tracts of permafrost in Canada, Russia, Alaska, Norway, Sweden, Finland and Greenland

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CSIRO: Permafrost carbon content double the old estimates

Sep 12, 2008 (M2 PRESSWIRE via COMTEX) --

New research indicates that the amount of frozen organic carbon locked away in the world's permafrost regions - a major potential source of atmospheric carbon dioxide (CO₂) and methane (CH₄) - is double what has been previously estimated.



In a paper published in the latest edition of Bioscience, an international team of scientists says whereas some of the CO₂ produced as a result of decomposition of previously frozen vegetation would be absorbed by increased, global warming-induced plant growth, it is likely the net effect would be a significant net increase in atmospheric CO₂.

"This is equivalent to twice the current amount of CO₂ in the world's atmosphere," says co-author, CSIRO's Dr Pep Canadell, from The Centre for Australian Weather and Climate Research - a partnership between CSIRO the Australian Bureau of Meteorology.

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Did this message offend you? Sign in to report abuse	<p>The three-year study concluded that the amount of carbon locked up in the world's permafrost is at least 1,500 billion tonnes more than double previous estimates and the equivalent of twice the current amount of Co2 in the world's atmosphere.</p> <p>Permafrost is frozen soil found at high latitudes, close to the north or south poles, and contains the remains of plants and animals which due to the extreme cold do not decompose, trapping carbon in the soil.</p> <p>This is the most accurate assessment yet of the amount of carbon contained in worldwide permafrost but the actual amount may well be higher, says CSIRO scientist and study team member Dr Pep Canadell.</p> <p>"We are now in the ballpark of what probably is there, there is still a big issue and that is the depth, our database goes down to three metres for much of the permafrost ... but we know that the depths can be much greater," he said.</p> <p>The level of carbon contained in the world's permafrost is of particular significance to climate change as once the carbon it contains begins to be released there is no way to stop it.</p> <p>This could lead to a large amount of extra carbon dioxide and methane being released into the atmosphere and potentially speeding up warming, a process some climate scientists refer to as a tipping point, Dr Canadell says.</p> <p>"Technically, we call it the climate carbon feedback and permafrost is a beautiful one and we know that some of these processes can potentially be irreversible," he said.</p> <p>"Irreversible doesn't mean that all the carbon is going to go into the atmosphere right away, but it means that when it starts it's fundamentally impossible to stop.</p>

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Melting permafrost may hasten global warming

DEBORAH SMITH SCIENCE EDITOR
13/09/2008 12:00:01 AM

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Frozen organic carbon locked in the soil would decompose, releasing greenhouse gases such as carbon dioxide and methane.

Scientists had estimated there were between 400 billion and 800 billion tonnes of carbon locked in these regions, but the study, published in the journal BioScience, has increased this to more than 1500 billion tonnes.

"This is equivalent to twice the current amount of carbon dioxide in the world's atmosphere," said Dr Canadell, from the Centre for Australian Weather and Climate Research, a partnership between CSIRO and the Australian Bureau of Meteorology.

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Permafrost carbon content double the old estimates

Source: CSIRO, the Commonwealth Scientific and Industrial Research Organisation
Published Sep. 12, 2008

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Permafrost carbon content double the old estimates

September 12, 2008

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Zimov

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Group: Global warming could cost Ohio its buckeyes (AP)



13 September 2008 - AP - It's not the best-researched global-warming theory, but it could be the most horrifying to certain fans of college football: Environmentalists said Friday that climate change might push the growing range of Ohio's iconic buckeye tree out of the state, leaving it for archival Michigan. [\[more...\]](#)

Study finds recent global warming unprecedented in 1,300 years (McClatchy Newspapers)



12 September 2008 - McClatchy Newspapers - WASHINGTON — A new scientific study adds evidence that temperatures in the Northern Hemisphere fluctuated a bit over time, but that the sharp increase during the past few decades is bigger than anything in at least 1,300 years. [\[more...\]](#)

Palin's statements on climate change murky (AP)



12 September 2008 - AP - Vice presidential candidate Sarah Palin's assertion that she believes humans contribute to global warming — made in her first major interview since joining the Republican ticket — is more definitive than her previous statements. [\[more...\]](#)

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Permafrost find adds to climate calamity

Adam Morton

September 13, 2008

The blanket of permafrost covering a fifth of the world's land mass traps twice as much greenhouse gas as previously thought - and is therefore much more likely to trigger rapid climate change as it melts, research says.

A paper published in the journal *Bioscience* estimates that more than 1500 billion tonnes of carbon dioxide and methane is locked in frozen vegetation at high latitudes. This is more than double the amount of greenhouse gas now in the atmosphere.

CSIRO atmospheric scientist Pep Canadell - part of an international team of 19 scientists that worked on the paper - said while it was not possible to accurately predict how much carbon would escape from the permafrost as it warmed, the release of even a fraction would accelerate climate change dramatically.

"With temperatures in the higher latitude estimated to rise by as much as 8 degrees by the end of this century, the world could experience a major melt of large tracts of permafrost in Canada, Russia, Alaska, Norway, Sweden, Finland and Greenland," he said.

The *Bioscience* paper is a first on two fronts: its researchers accessed long-term Russian data sets that had never been

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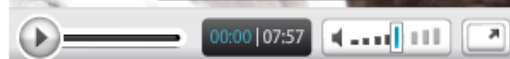
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Permafrost carbon estimates doubled

September 12, 2008, 8:48 pm

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This could lead to a large amount of extra carbon dioxide and methane being released into the atmosphere and potentially speeding up warming, a process some climate scientists refer to as a tipping point, Dr Canadell says.

"Technically, we call it the climate carbon feedback and permafrost is a beautiful one and we know that some of these processes can potentially be irreversible," he said.

"Irreversible doesn't mean that all the carbon is going to go into the atmosphere right away, but it means that when it starts it's fundamentally impossible to stop.

"It may take a few hundred years to melt and to release a substantial amount of carbon but there is nothing that humans can do once these things start."

Dr Canadell likened the process to a massive compost pile which once started generates its own heat that would continue even if temperatures were to fall.

"This is like a big compost pile, so when you start the decomposition of the compost pile, it is self heating," he said.

"It's hot when you touch it so there is a point where you no longer need the external temperature driving that



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Melting permafrost may hasten global warming

Twice as much carbon is locked away in the frozen soils of the earth's permafrost regions as had been thought, raising the concern that global warming will accelerate faster than expected once the soils start to thaw.

A three-year study by an international team of researchers including Pep Canadell of the CSIRO produced the new estimate, based on cores up to three metres deep taken from permafrost regions, particularly across Russia.

Dr Canadell said temperatures near the poles were predicted to rise by as much as 8 degrees by the end of the century. "The world could experience a major melt of large tracts of permafrost in Canada, Russia, Alaska, Norway, Sweden, Finland and Greenland."

Frozen organic carbon locked in the soil would decompose, releasing greenhouse gases such as carbon dioxide and methane.

Scientists had estimated there were between 400 billion and 800 billion tonnes of carbon locked in these regions, but the study, published in the journal BioScience, has increased this to more than 1500 billion tonnes.

[Sydney Morning Herald](#)

Posted on Sunday, September 14 @ 03:48:39 PDT by [waegari](#)



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Permafrost Organic Carbon Content Double Prior Estimates

14 SEPTEMBER 2008

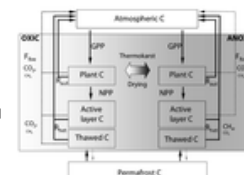
An international, three-year study involving collaboration between scientists from Australia, Russia, the US, the UK, Canada and Europe has [estimated](#) that the amount of frozen organic carbon locked away in the world's permafrost regions—a major potential source of atmospheric carbon dioxide (CO_2) and methane (CH_4)—is 1,672 petagrams (1,672 billion metric tons). This is more than double prior estimates of the world's high-latitude carbon inventory, and more than twice the size of the current atmospheric carbon pool.

In an open access paper published in the September 2008 edition of *Bioscience*, the team concludes that whereas some of the CO_2 produced as a result of decomposition of previously frozen vegetation would be absorbed by increased, global warming-induced plant growth, it is likely the net effect would be a significant net increase in atmospheric CO_2 .

Permafrost C, once thawed, can enter ecosystems that have either predominantly oxic (oxygen present) or predominantly anoxic (oxygen limited) soil conditions. [See diagram above.] There is a gradient of water saturation on the landscape that ranges from fully oxic to fully anoxic, and ecosystems can become drier as permafrost thaws (shrinking lake area, drying wetland/peatlands), or wetter (thermokarst lakes). The soil oxygen status is a key determinant of the rate and form of C loss to the atmosphere.

Decomposition in oxic soils releases primarily CO_2 , whereas anoxic decomposition produces both CH_4 and CO_2 , but at a lower total emission rate. Fire releases mostly CO_2 , but also some CH_4 , and can burn upland and wetland ecosystems, although burning of organic soils at depth is restricted in wetter environments unless there is severe drought.

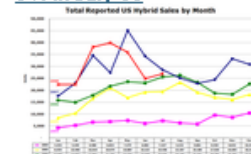
These emissions of C through decomposition are offset by gross and



Conceptual diagram of the effect of permafrost thawing on climate. Decomposition in oxic soils releases primarily CO_2 , whereas anoxic decomposition produces both CH_4 and CO_2 , but at a lower total emission rate. Fire releases mostly CO_2 , but also some CH_4 . Click to enlarge. Credit: Bioscience

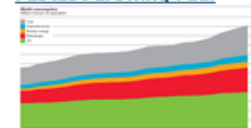
From the Dashboard

US Sales of Hybrids Down 6% in July 08



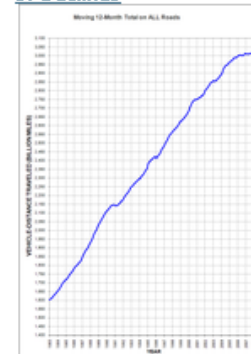
US sales of hybrids were down 6% in July 2008 year-on-year, for a new vehicle market share of 2.4% of the month.

Global Energy Consumption Up; Coal Fastest Growing Fuel



The ongoing strength of world economic growth last year, despite financial market turmoil which began in August, continued to support global energy consumption. Although growth in primary energy consumption slowed in 2007 compared to 2006, but at 2.4% it was still above the 10-year average for the fifth consecutive year, according to the BP Statistical Review of World Energy. Coal remained the fastest-growing fuel, but oil consumption grew slowly.

US VMT Down 1.8% in April; Sixth Straight Month of Declines



Permafrost Holds Twice as Much Greenhouse Gases as Previously Thought: Over 1500 Billion Tons of CO₂ and Methane



Image from jurvetson

Following on the heels of a recently published study in the journal *Nature Geoscience*, which estimated that Arctic permafrost could hold 60% more organic carbon than previously thought, a team of scientists from Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) has found that the planet's permafrost layers – comprising an area that covers a fifth of Earth's land mass - store *twice* as much methane and carbon dioxide as previously believed.

The results of their study, published in the journal *Bioscience*, state that permafrost layers located at high altitudes contain over 1500 billion tons of CO₂ and methane, or twice the amount of GHG currently present in the atmosphere.



IGNORANCE MORE FREQUENTLY BEGETS CONFIDENCE THAN DOES KNOWLEDGE: IT IS THOSE WHO KNOW LITTLE, NOT THOSE WHO KNOW MUCH, WHO SO POSITIVELY ASSERT THAT THIS OR THAT PROBLEM WILL NEVER BE SOLVED BY SCIENCE.

-Charles Darwin (The Descent of Man, 1871)

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