

urgent and substantial problem. But initial findings from the *World Phosphate Rock Reserves and Resources* study conducted this year by the IFDC, an international non-profit organization based in Muscle Shoals, Alabama, and formerly known as the International Fertilizer Development Center, suggest that phosphate rock deposits should last for between 300 and 400 years.

Accurate information about phosphate reserves is hard to come by, and the IFDC concedes that more work is needed to hone its estimates. The mining industry, governments and interested researchers should accept the organization's invitation to collaborate in this process.

The phosphate issue runs beyond gaining assurances that total global supply will meet demand. There remain important concerns that phosphate and other fertilizers are being squandered in some parts of the world, whereas farmers in other regions cannot obtain them at a reasonable cost.

After decades of wanton overuse, farmers in the United States, Europe and elsewhere are now using sophisticated assessments to tell them when, how much and in what proportion fertilizer should be applied. That has led to a flattening out in global demand for phosphate fertilizer, despite continued growth in food production.

But elsewhere in the world, especially in Asia, farmers are still applying fertilizer in excess (see *Nature* doi:10.1038/news.2010.498; 2010). At the same time, farmers in the poorest countries such as some in Africa, find fertilizer prices inflated to unaffordable levels by high transportation costs and local market conditions.

In addition, current fertilizer-production methods fail to maximize the efficient conversion of phosphate rock into fertilizer. The supply of the rock is heavily concentrated in two nations, China

and Morocco, on whose good faith the rest of the world relies for its phosphate supplies. That faith has been shaken by extreme price fluctuations in recent years.

Yet the heavy dependence of food production on fertilizers, inequalities of supply and the need for sustainable use of fertilizers — including recycling — are largely missing from discussions on approaches to sustainable development. They were only mentioned in passing, for example, at the United Nations' world summit on food security in Rome last November.

Hydrologists, soil researchers and food scientists have begun to raise awareness of some of the issues surrounding phosphates. A discussion will be devoted to the topic at the Crop World 2010 meeting in London next week, in which researchers will be joined by industry and government representatives, including John Beddington, the UK government's chief scientific adviser, who has worked hard to raise political awareness of food-security issues.

These efforts would be strengthened if an international body, such as the UN Food and Agriculture Organization, started to seriously champion the issue of sustainable fertilizer use. The organization already tracks fertilizer demand and supply, and has produced reports on phosphate fertilizer use. It doesn't have a specific programme for sustainable fertilizers, but its departments of agriculture and natural resources do some work in this area, giving it a base on which to build. It now needs to push this issue out from the sidelines and into the policy-making process that will shape the future of agriculture and sustainable development. ■

Space hitch-hiker

Commercial spacecraft with room to carry experiments could give science a lift.

A study on the environmental impacts of space tourism suggests that a surge in private access to space could speed global warming. Led by Martin Ross, an atmospheric scientist at the Aerospace Corporation in El Segundo, California, it shows that sooty emissions from 1,000 rocket launches per year would add as much to climate change as current emissions from the global aviation industry. It has been accepted for publication by *Geophysical Research Letters*.

Perhaps the most striking aspect of the study is not the projected impact on polar temperature and sea ice, but the size of the industry it models. Three launches a day? Don't bet against it. Barely a decade after US multimillionaire Dennis Tito paid around US\$20 million for a trip to the International Space Station (ISS), space tourism, at least the suborbital type, seems poised for serious lift-off.

The private spaceflight industry is making steady progress. Spaceport America, a launch site in Las Cruces, New Mexico, opened its first runway last week. Earlier this month, US President Barack Obama signed into law the NASA Authorization Act, which, subject to approval by Congress, will see the agency hand over \$15 million a year to help commercial suborbital efforts.

NASA is keen because it sees what many space scientists have been slow to realize: such suborbital flights could carry research payloads. Virgin Galactic, a pioneer of space tourism, has already indicated that it would be happy to host scientific experiments on its SpaceShipTwo vehicle. A number of fields including atmospheric, space and microgravity research could benefit. A closer relationship with scientists could help the industry in return,

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through work to quantify and reduce its environmental impact, for instance.

A strong advocate of closer ties between rocketeers and researchers is Alan Stern, a planetary scientist at the Southwest Research Institute in San Antonio, Texas, and a former NASA associate administrator, who chairs the Suborbital Applications Researchers Group of the Commercial Spaceflight Federation in Washington DC. Stern says that private suborbital vehicles will be a game-changer for science, because of low costs and the high number of flights. Earlier this year, his group organized the first conference to promote the benefits of private space flights to scientists. A second event is scheduled for February 2011 at the University of Central Florida in Orlando.

Space scientists who wish to fly experiments currently face high costs and long waits for room on the ISS or sounding rockets, or frustratingly brief periods of microgravity in drop-tubes or parabolic aircraft (known with little affection by those who have been aboard as 'vomit comets'). Suborbital flights could offer several minutes of weightlessness for a fraction of the cost of a conventional launch. And the experiments could be supervised by scientists able to fly alongside their kit. An early winner could be the search for vulcanoids — asteroids that orbit the Sun closer than Mercury. None has yet been discovered, perhaps because observing them from the ground or high-altitude flights is so awkward.

Although NASA has been quick to identify and nurture the potential of space-tourism operators, others have been more sluggish to recognize their potential. The European Space Agency, for example, has an official position on private suborbital flights only of "cautious interest and informed support". Countries outside the United States have not yet taken the necessary legal steps to open their skies to private operators. Perhaps this reflects scepticism about whether the endeavour will reach the necessary economy of scale, which depends on the number of tourists who sign up. That is a reasonable position at this stage, but space scientists and administrators should drop any snobbish objections they have to the private sector. Those who do not embrace the possibilities could find themselves, quite literally, left behind. ■