

# Study reveals nature's marketplaces can parallel those of humans

August 12 2011, by John Dunn

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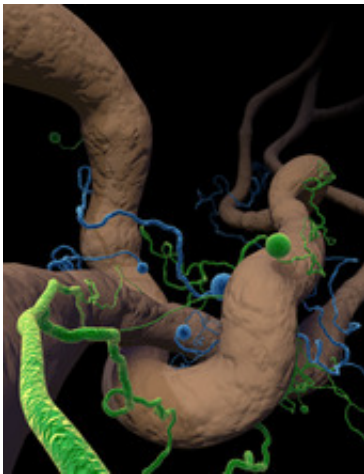


Image: Dana Hamers

World financial markets may be reeling from new setbacks, but it turns out there's a secret economy right under our noses and it's thriving. The movers and shakers, however, are plants and fungi.

According to a new study scheduled to appear in the Aug. 12 issue of the journal *Science*, flora interact [in a complex underground economy](#) in which they exchange — even barter — commodities, much like traders in a stock market.

Insights gleaned from the international study may one day lead to improvements in agriculture by optimizing how [fungi](#) interact with crop

[plants](#), but there's also reason for concern.

“Many of the things that humans are doing on this planet actually change the value of goods and services exchanged between mutualist species,” some of which have been evolving for more than 450 million years, said Todd Palmer, an assistant professor of biology at the University of Florida. Palmer was part of the research team that included scientists from the Netherlands, France, Switzerland, the U.S. and the United Kingdom.

Ecologists have long wondered why some species cooperate in mutualism — an association of animals or plants in which partners benefit from the relationship. Mutualism networks are generally complex. Multiple fungi, for example, colonize a single root, while each simultaneously forms connections with numerous plants, resulting in a delicate and intricate sharing of resources. The problem is that instead of cooperating, some individuals “cheat,” taking resources while giving little in return. So what prevents these mutualisms from disintegrating?

The collaborators focused on Medicago — a legume bearing plant — and arbuscular mycorrhizal fungi, which colonize plant roots and trade nutrients for sugars from the plant.

First, the researchers traced the real-time flow of sugars from the host into the ribonucleic acid, or RNA, of fungi that were either cooperating or ‘shirking their duties’. They found that more carbon was consistently directed to the best fungal partner.

“The biggest surprise was that plants can discriminate, even on a single length of their own root system, which fungi are cooperating and which fungi are not so cooperative,” Palmer said.

Because plants also may cheat fungal partners by hoarding sugars, the

researchers then manipulated plant ‘behavior’ and allowed the fungi to associate with both cooperative or less-cooperative plant partners. They discovered that the fungi consistently directed more nutrients to the plants supplying more sugars.

“We were astounded by the bargaining power of the fungi,” said fellow researcher Toby Kiers, an assistant professor in evolutionary biology at the Institute of Ecological Science at the Vrije University in the Netherlands. “We have seen cases in which the host plant ‘enslaves’ the bacterial or fungal partner, and punishes bad behavior. Now we discovered the reverse: Fungal partners denying plants nutrients if they failed to cooperate.”

These “biological markets,” which include many species trading goods or services, reward cooperators and thus behave much like human markets.

Such market discipline appears to limit the success of individuals that ‘cheat’. However, so-called cheaters may provide benefits to hosts that researchers haven’t yet detected.

As intrigued as they are by the discovery of the underground plant economy, the researchers are equally concerned about how human activity might be affecting it.

“The world is becoming more enriched with nutrients from agriculture, global emissions and other sources,” Kiers said. “How will plants and fungi respond to this radical shift in supply and demand? Will nutrient pollution lead to the collapse of this ancient market?”

Provided by University of Florida

Citation: Study reveals nature's marketplaces can parallel those of humans (2011, August 12)

retrieved 27 April 2024 from

<https://phys.org/news/2011-08-reveals-nature-marketplaces-parallel-humans.html>

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