triggered rather than spontaneous slow-slip events. Temperature, effective stress, rheology and loading velocity all influence where transitional friction behaviour occurs along faults. Given these many unknowns, it remains unclear whether slow slip plays a role in promoting the next big earthquake on a given fault.

Although many uncertainties remain, Ikari and colleagues[1] have shown that the frictional properties of fault rocks can explain how both fast and slow fault slip could occur on the same part of a fault. Thus, in subduction zones worldwide, it is possible that any shallow fault patch that typically generates slow-slip events could also host large, shallow slip during earthquakes and tsunamis. ❐

Heather M. Savage is in the Division of Seismology, Geology and Tectonophysics, Lamont-Doherty Earth Observatory, Columbia University, Palisades, New York 10964-8000, USA.
e-mail: hsavage@ldeo.columbia.edu

References
1. Ikari, M. J. *et al. Nature Geosci.* **8,** 870–874 (2015).
2. Dieterich, J. H. *J. Geophys. Res.* **84,** 2161–2168 (1979).
3. Ruina, A. *J. Geophys. Res.* **88,** 10359–10370 (1983).
4. Scholz, C. H. *Nature* **391,** 37–42 (1998).
5. Walter, J. I., Schwartz, S. Y., Protti, J. M. & Gonzalez, V. *Geophys. Res. Lett.* **38,** L01307 (2011).
6. Fujiwara, T. *et al. Science* **334,** 1240 (2011).
7. Ito, Y. *et al. Geophys. Res. Lett.* **38,** L00G05 (2011).
8. Fukao, Y. & Kanjo, K. *Tectonophysics* **67,** 153–162 (1980).
9. Ito, Y. *et al. Tectonophysics* **600,** 14–26 (2013).
10. Ikari, M. J., Kameda, J., Saffer, D. M. & Kopf, A. J. *Earth Planet. Sci. Lett.* **412,** 35–41 (2015).

Published online: 5 October 2015

SUSTAINABILITY

Putting local food to the test

People increasingly want to know where their food comes from and how its production affects the environment. Momentum has built around a number of ideas to help make our food systems more sustainable, including developing local food supply systems. Eating food produced locally seems intuitively more sustainable than eating food produced a thousand miles away, as locally produced food would presumably travel shorter distances, resulting in lower greenhouse gas emissions and air pollution. However, our food systems can be complex, involving a network of production, processing, storage and transportation resources, and there may be efficiencies present in larger distribution networks that can provide advantages over shortening farm-to-table distances.

To understand some of the economic and environmental effects of localizing food systems, Charles Nicholson and colleagues evaluated the dairy supply chains in the Northeastern United States (*Environ. Sci. Technol.* http://doi.org/77c; 2015). Milk is a particularly interesting case. It is both a consumer product and also a raw material for the production of cheese, yogurt, butter and other products. Milk is therefore involved in a complex production and distribution network. Nicholson and colleagues developed an empirical model of the supply chain, incorporating spatially explicit consideration of the locations of production, processing, storage and demand that include ten different dairy products, six different types of processing plants and multiple stages of processing.

They considered three scenarios: a baseline scenario in which milk and dairy products consumed in the Northeast can be produced anywhere in the country; a localization-by-state scenario in which potentially self-sufficient states consume only locally produced fluid milk; and a localization-by-region scenario in which three geographic regions of the Northeast can only consume locally produced milk. In all scenarios, the states and regions can use milk produced anywhere, including outside the Northeast, for production of other dairy products.

Localization by state and by region increased product miles travelled by fluid milk by about 7% and 15%, respectively, for the whole of the Northeast — although travel distances did decrease for some states and products. State or regional boundaries in the localization scenarios restrict the movement of milk and dairy products, increasing the distance between production and consumption locations. The localization restrictions on liquid milk also affect the state or regional availability of milk used for other dairy products, which can result in longer travel distances as well.

Consequently, both localization scenarios lead to an increase in Northeast emissions of CO_2 equivalents, $PM_{2.5}$ and NO_x of about 2% each. The emissions do not scale linearly with the product miles, which could be in part due to greater use of larger trucks, which have lower emissions per ton-mile than smaller trucks. Localization also contributes minimally to local economies, creating about three new jobs in the Northeast and new economic activity totalling less than US$1.7 million per month, a tiny percentage of the multi-billion-dollar milk industry in the Northeast.

In searching for ways to make our food systems more sustainable, localizing food systems can be a seductive idea simply because it seems so logical. However, Nicholson and colleagues have demonstrated that when we consider the actual complexity of our existing food systems, trade-offs in allocating resources such as land or processing plants and changes in transportation efficiencies can produce outcomes that may be the very opposite of the goals of the intended policies.

JONATHAN E. HICKMAN