Serendipity: The Buzz About Swarm Theory

By **KAREN TELLEEN-LAWTON, NOOZHAWK COLUMNIST** | Posted on 05/22/2008

Small life forms teach big lessons in using collective intelligence to guide sustainable systems.

You've probably never spotted an ant lieutenant — the ant in charge of assigning duties and confirming that each task is completed. Ant colonies are leaderless, yet they typically make the right decisions. Biologists studying group behavior in animals have been startled to learn how much is applicable to humans. Their results can help us design sustainable systems, from running smooth meetings to unkinking Highway 101.

Karen Telleen-Lawton (Don Matsumoto photo)

Wayne Iba, a computer science professor at Westmont College, works in this field, loosely called "swarm theory." His interest centers on group and individual identity. This topic, as well as others in the growing body of knowledge, was explained in layman's terms in a National Geographic article by Peter Miller.

"One key to an ant colony," Miller writes, "is that no one's in charge. It relies instead upon countless interactions between individual ants, each of which is following simple rules of thumb. Scientists describe such a system as self-organizing."

I like the idea of learning from nature, not only because it seems natural. In this new field, advances are evident in a plethora of technologies and fields. Insects, for example, can teach us about choices and traffic.

Biologists studied colonies of honeybees (Apis mellifera) to learn how they choose a new home. They set out a half-dozen bee boxes, each with a known design flaw, plus one they believed met all of the requirements of a perfect bee hollow. Bees immediately scattered to explore the region and soon returned to the swarm, extolling the virtues of their discovery in song and dance. Well, maybe just dance. Then more scouts buzzed away to check out the data, presumably flying to the location most appealing based on the competing dances. The box designed to meet all of the bee requirements emerged as the wings-down winner.

Swarm behavior is characterized by decentralized control, response to local cues and simple rules of thumb. But can humans operate in a system without hierarchy?

“We’re not used to solving decentralized problems in a decentralized way. We can’t control an emergent phenomenon like traffic by putting stop signs and lights everywhere,” said Eric Bonabeau, a complexity theorist at the University of Cambridge. “But the idea of shaping traffic as a self-organizing system, that’s very exciting.”

Southwest Airlines tested an ant-based model to improve tarmac traffic flow in Phoenix. It was faced with a basic operations research problem: 200 takeoffs and landings per day, two runways, three concourses and a goal of minimizing process time. Scientists designed an algorithm mimicking ants’ decision-making. The algorithm was simple: When deciding which gate to use, avoid the slow gates and return to the fast ones. The Santa Barbara Airport most likely could benefit from such a simulation.

Far from being ruled by chaos, these studies point to a collective intelligence driven by the individual responsibility exercised by its members. Some of these issues may emerge from an upcoming open class at Westmont called ”Flying Intelligence” being co-taught by Iba and his colleague, Marilyn McIntyre. The weeklong class, open to the public, includes a consideration of how people “read” the behaviors of life forms and art forms, and what that reading entails.

Students may just learn to look up to ants.

Karen Telleen-Lawton’s column is a mélange of observations supporting sustainability. Graze her writing and excerpts from Canyon Voices: the Nature of Rattlesnake Canyon at www.CanyonVoices.com.