When Are Golf Greens Stable?

BY KARL DANNEBERGER

With summer stress periods on the horizon, golf course superintendents often wonder why turfgrass species that are so carefully maintained are so easy to lose. From a management perspective, what makes for a stable putting green? Ecologically, one misnomer is that complexity leads to stability, suggesting single- or two-grass species greens are unstable.

The generally held belief that complexity enhances the stability was based on early "conventional wisdom" in ecology that increased complexity — as in, increasing number of species — increases stability. This wisdom, developed in the late 1950s and 60s, was based on several statements, one of which tended to resonate through the agronomic discipline that crop monocultures were ecologically unstable communities because they were especially susceptible to destruction by pests or environmental disturbances.

As research progressed in the 1970s, many of the statements that complexity added to stability were found to be untrue or could be interpreted at best in another fashion. For example, the crop monoculture statement ignored the difference in co-evolution between natural and agricultural systems, and that many crops are early successional species, which by definition are subject to rapid change.

As research continued into plant communities and sophisticated mathematical models that looked at increased species number were developed, bonding and interactions among the species, studies found that increasing complexity lead to instability. Studies, which began in the 1970s, had ecologists comparing species-rich and species-poor communities. They found that when a disturbance occurred the species-rich communities lost diversity, and never returned to the pre-disturbance community, while the species-poor were more likely to return.

Ecological stability is based on two components, resiliency and resistance. Resiliency is the speed at which a community returns to its former state after a disturbance or displacement. Resistance is used to describe a community's ability to avoid displacement or dislocation.

ECOLOGICAL STABILITY IS BASED ON RESILIENCY AND RESISTANCE

Of special interest when discussing stability is *Poa annua* putting greens. Initially established to desirable turfgrass specie(s), these greens changed to *Poa annua* from disturbances either environmentally or biologically (pests, and management). As *Poa annua* greens, they exhibit high resiliency and resistance to change.

When *Poa annua* greens are disturbed by pests and environmental or management stress, the greens often return to their predisturbance state. In other words, when *Poa annua* dies, it is a good bet that *Poa annua* will return. These greens also exhibit a high degree of resistance. Anyone who has tried to convert *Poa annua* greens to creeping bentgrass knows what I'm talking about.

The final component that's important in community stability is the environment. Either on a global or local level, communities or species that exhibit adaptation or characteristics within a narrow range of environmental conditions are considered to be dynamically fragile, while those adapted to a range of conditions would be considered dynamically robust. Although *Poa annua* is found globally, greens managed at current levels exhibit a more fragile nature. Greens managed well within the desirable environmental conditions do well and are desirable; those on the fringes of environmental adaptability are at greater risk.

Finally, I would say that the relationship between the complexity of a community and its inherent stability in a global sense is not always clear. It may vary with the exact nature of the community — in our case a putting green and how it is damaged, and from a scientific perspective the way stability is assessed. However, with many ecological systems the overall tendency for stability to increase comes with decreasing complexity.

Karl Danneberger, Ph.D., is Golfdom's science editor and a Ohio State University turfgrass professor.