

Scientist in Action

Dr. David Knochel grew up on the Front Range of Colorado, near Denver. His family has a long history of ranching in Colorado, and as a child, his family went hiking and camping often. Thanks to his parents, David gained an appreciation of nature and curiosity in the natural world. Now, Dr. Knochel works as an ecologist at the University of Colorado, Boulder. An **ecologist** is someone who studies the interactions between Earth's living organisms and the environment. In other words, nature is his playground.



Dr. Knochel in a ponderosa forest where he studies spotted knapweed, and taking a soil sample from a Boulder county grassland.

David is fascinated by how plants and insects interact within an **ecosystem**, especially plants that are considered **noxious weeds**. In his research, he uses greenhouse and field experiments to understand how weeds can be controlled **sustainably**. He also is interested in how **climate change** will affect our ability to control weeds and make appropriate management decisions. For example, one method to reduce the numbers of an unwanted pest is by using insects, or **biological controls**. For example, scientists have helped farmers by studying and releasing various biocontrol flies that attack woolly apple aphids, a pest that could otherwise destroy apple orchards. A wide variety of organisms, such as viruses, bacteria, fungi, insects, and even large mammals like elk, naturally control the abundance of plants. Some of these organisms can also be effective for the control of widespread, **invasive plants**.

Spotted knapweed, a plant **native** to Eastern Europe, is a widespread and very problematic

weed in rangelands and forest of the western United States. Millions of **hectares** (1 hectare = 2 soccer fields) of land are infested with this non-native plant.



The weed is causing reductions in **biodiversity**, loss of **habitat** for wild animals, and is a pain to walk through!

Open space managers, ranchers, farmers, **conservationists**, and homeowners have great interest in finding easier, cheaper, and more sustainable methods to control unwanted weeds on their lands. As a graduate student, David chose to study how biocontrols affect spotted knapweed. He conducted experiments testing a combination of three species of insects: a flower head weevil, a gall fly, and a root weevil, would impact spotted knapweed (see photo below). Using these biocontrols, if effective, could replace other extremely costly methods of removing spotted knapweed from forests and grasslands in Colorado and the west. Other weed control methods, such as mowing or herbicide spraying, are not only more costly, but can also cause direct negative impacts to the environment.



To study the effects of the three biocontrol insects on this plant, David grew, observed, and recorded **data** from hundreds of spotted knapweed plants. He tested how combinations of the insects might affect the plant's root and leaf growth, or plant **biomass**, and also the numbers of flowers and seeds the plants produced. After nearly three years of study, David analyzed the data using **statistics**. He found that when the root weevil and the flower-head weevil were feeding on the plant simultaneously, the plant was damaged more severely. He also found that the two weevil species are effective in reducing **populations** of the weed. He is now doing further research to determine how this damage can explain the eventually long-term population reductions that he observes at the field site in Left Hand Canyon. Importantly, Dr. Knochel also found that when other 'native' plants were growing alongside the knapweed, this helped the insects win the battle, and reduced knapweed success.

In summary, David spent a childhood close to nature and now spends his time doing interesting scientific experiments in the great outdoors. He works with a diverse set of people, including teachers, college students, researchers, and his primary advisor, Dr. Timothy Seastedt, at CU and the Institute of Arctic and Alpine Research.

Glossary

hectare A unit of measuring surface area of land, equal to 10,000 m² (1 *are* = 100 m²)

biocontrol (biological control) An organism introduced to an area in order to control a pest

biodiversity The variation of life forms in a given ecosystem, biome, or Earth

biomass The mass of living plant tissue in a given area at a given time

climate change A global phenomenon, now known to be greatly affected by human activities,

that includes changes in temperature and precipitation, across many ecosystems.

conservationist A person who maintains natural areas or protects threatened species

data A collection of facts from which conclusions can be drawn

ecologist A biologist who studies the relation between organisms and their environment

ecosystem A community of living organisms interacting with one another and with the external environment (climate, soil, precipitation)

habitat A specific place or natural conditions in which an organism lives

invasive plant A term that describes the especially troublesome non-native weeds, that can invade an area, spread rapidly, and cause large ecological and economic problems

native A term used to identify the home land of a species, the area it originally and naturally inhabits

noxious weeds A weed specified by law as being undesirable, toxic to animals, troublesome, or difficult to control

open space manager A person or group whose job is to keep an area of land productive and biodiverse

population All of the individuals of a given species found in a given area

statistics The science of making sense of a collection of numerical data, often relating to groups of individuals or measurements from experimental samples

sustainable The capacity to endure, without excessively depleting a resource or damaging the environment