New scientific studies reveal Midwestern frogs decline, mammal populations altered by invasive plant

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Researchers at Lincoln Park Zoo and Northern Illinois University have discovered a new culprit contributing to amphibian decline and altered mammal distribution throughout the Midwest region – the invasive plant European buckthorn. This non-native shrub, which has invaded two-thirds of the United States, has long been known to negatively impact plant community composition and forest structure, but these two innovative studies slated to publish in upcoming editions of the *Journal of Herpetology* and *Natural Areas Journal* demonstrate how this shrub negatively impacts native amphibians and affects habitat use by mammals including increased prevalence of coyotes and other carnivores.

Amphibians are facing an extinction crisis worldwide, with 165 species likely having gone extinct in recent years according to the Amphibian Ark, a coalition of conservationists devoted to seeking solutions to the decline. Lincoln Park Zoo Reintroduction Biologist Allison Sacerdote-Velat, Ph.D. and Northern Illinois University Professor of Biological Sciences Richard King have identified European buckthorn as a contributor to amphibian decline in the Chicagoland area. The plant releases the chemical compound emodin, which is produced in the leaves, fruit, bark and roots of the plant, into the amphibian breeding pond environment at various times of year. Sacerdote-Velat and King's research has found that emodin is toxic to amphibian embryos, disrupting their development, preventing hatching.

"Levels of emodin in the environment are greatest at leaf out, which is occurring right now in early spring. This coincides with breeding activity of several early-breeding Midwestern amphibian species including western chorus frogs and blue-spotted salamanders," explained Sacerdote-Velat. "Several amphibian species exhibit low hatching rates in sites that are heavily infested with European buckthorn."

The Chicago Wilderness 2004 Woodland Audit found that in the Chicagoland area alone, more than 26 million stems of European buckthorn exist with a density of 558 stems per acre. Whilst this study specifically found emodin to detrimentally impact development of two species of frogs, Western chorus frogs and African clawed frog (a common test species for environmental toxicity studies), Sacerdote-Velat and King hypothesize that emodin may impact the reproductive success of other frog species in regions where buckthorn is not native.

"Western chorus frogs are quite common in the Midwest, and people in Illinois who have never seen them have probably heard them in the springtime," said King, who has continued to conduct research with Sacerdote-Velat after having served as her Ph.D. adviser at NIU. "The new study demonstrates how a shrub that is viewed by many as a decorative plant can become invasive and have unexpected and damaging effects on natural ecosystems."

Additionally, new research from the zoo's Urban Wildlife Institute reveals how the presence of the invasive shrub in forest preserves and natural areas correlates to increased prevalence of carnivores. Previous research by Ken Schmidt of Texas Tech University and Chris Whelan of Illinois Natural History Survey documented that these carnivores can prey more easily on native bird eggs and nestlings such as robins when nests are built in buckthorn and honeysuckle compared to nests built in native shrubs or trees.

"The relationship between invasive plants and wildlife is complex. This is the first study of its kind to investigate the association between buckthorn and habitat use by mammal species," explained Director of the Urban Wildlife Institute Seth Magle, Ph.D. "We know based on prior research that birds which build nests in buckthorn are more susceptible to predation. Our study found that the presence of buckthorn alters wildlife distribution and attracts some carnivore species. We now know that there are significantly more coyotes, raccoons and opossums in buckthorn invaded areas, and significantly fewer white-tailed deer."

Magle hypothesizes that the carnivores could be drawn to buckthorn areas because birds and their nests are easier to prey upon. He suggests that deer may be avoiding these areas because buckthorn is an undesirable food source, and also due to the increased prevalence of coyotes. Research shows that deer fawns are a relatively common food item for Chicago-area coyotes.

Both Magle and Sacerdote-Velat agree that these findings are significant. The studies demonstrate how the high-density prevalence of this non-native plant is shifting population dynamics and negatively impacting a variety of native animal populations. They suggest land owners and managers should consider invasive species management and habitat restoration. In some areas, like Lake County Forest Preserve District where Sacerdote-Velat works regularly, ecologists and land managers have been committed to removing buckthorn from the area. "I hope that this new research will encourage other regions and land managers to take swift and decisive action to work to remove this invasive plant," she said.

Provided by Lincoln Park Zoo

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