Best Management Practices for Crawfish Frogs (*Lithobates areolatus*): A Guide for Land Managers

Midwest PARC Crawfish Frog Task Team[1]

Introduction

Crawfish Frogs (*Lithobates areolatus*) are a grassland-dwelling species inhabiting the south-central United States (Fig. 1). Their distribution appears to be limited by extreme dryness in the West, by extreme cold in the North, by forests in the East, and by the Gulf of Mexico in the South. Within this range, the presence of populations is limited by the presence of upland crayfish burrows. Crawfish Frogs have experienced a 35% decrease in county-level occupancy across their range; declines have been most severe east of the Mississippi River, with a nearly 60% drop in county-level occupancy (Fig. 1). Crawfish Frogs are listed as a species of conservation concern in each of the 13 states they currently or historically occupied and are a Regional Species of Greatest Conservation Need. Crawfish Frog declines have been tied closely to the destruction of upland grasslands where frogs spend most of the year inhabiting crayfish burrows, and the draining of seasonal and semi-permanent wetlands where they breed during late winter and early spring. Despite severe range retractions, especially in the agriculturally-dominated eastern portion of their range, Crawfish Frogs have shown a striking ability to colonize restored sites containing three key habitat features: expansive grassy terrestrial habitat, fishless seasonal or semi-permanent wetlands, and upland crayfish burrows. The loss of one or more of these habitat components can quickly eliminate a local population and reduce larger population networks to smaller, fragmented colonies disconnected by areas of uninhabitable terrain.

Unique Aspects of Crawfish Frog Biology

- Crawfish Frogs are obligate crayfish burrow dwellers;
- Upland crayfish burrows are essential to Crawfish Frog survival by providing shelter during a predator attack and from fire and temperature extremes;
- Crawfish Frogs can occupy burrows more than one kilometer away from breeding wetlands;
- Crawfish Frogs are philopatric, returning to their home burrow following breeding year after year, for as many as five years;
- When not breeding, Crawfish Frogs have a miniscule home range ($1/20^{th}$ m^2) including their primary burrow and a "feeding platform;"

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- Adult Crawfish Frogs do not choose crayfish burrows randomly but rather select those that "fit" them in terms of bore (diameter);
- Crawfish Frogs exhibit two unique adaptations for crayfish-burrow dwelling, one behavioral, one morphological;
- Crawfish Frogs not inhabiting crayfish burrows are 12 times more susceptible to being preyed upon;
- Adjacent populations (when present) may be part of a larger metapopulation network.

This best management practices ("BMP") document has been modified from Lannoo and Robb (2012) and Lannoo and Stiles (2020) and is designed to assist public and private land managers wishing to preserve and expand Crawfish Frog populations. The management practices described herein are centered around the unique biology of Crawfish Frogs but undoubtedly will benefit many other grassland-dwelling species.

Crawfish Frog Life History

Crawfish Frogs spend 10–11 months of the year at their primary burrows, which were originally created by terrestrial (upland) species of burrowing crayfish (Fig. 2). Each spring the frogs migrate to fishless, temporary wetlands and ponds, which can be over a kilometer away, to mate and lay their eggs (Fig. 3). After mating, the frogs typically return to the same primary burrow. Crawfish Frogs show strong site fidelity, using the same burrow year after year for up to five years, although wet conditions that flood burrows will cause Crawfish Frogs to abandon them to find drier sites. Research using radio telemetry at an Indiana site found that 79% of Crawfish Frogs inhabit primary burrows within 500 m of their breeding wetland, and 94% of frogs inhabit burrows within 750 m of the wetland. The farthest distance between a frog's primary burrow and its breeding wetland was 1,020 m. Crawfish Frog burrows provide protection from temperature extremes and allow the frogs to hydrate during summer heat. Crayfish burrows serve as a predator deterrent—Crawfish Frogs are 12 times more likely to be eaten by a predator when away from their burrows. Because frogs do not create their own burrows, it is critical to protect the primary burrows of Crawfish Frogs to ensure their long-term survival.

In terms of Crawfish Frog conservation, the relationship between an adult frog and its burrow cannot be overstated. Crawfish Frogs occupy burrows that fit their body dimensions and are philopatric to their home burrows. Any anthropogenic activities, including land management techniques such as strip disking, that compromise the integrity of a Crawfish Frog's burrow will put individual frogs at risk. Large-scale management practices detrimental to Crawfish Frog burrow integrity will put populations at risk.

Best Management Practices

Terrestrial Habitat.—Crawfish Frog populations are associated with several forms of open-canopy habitat including managed prairie, grassy meadow, abandoned field, hayfield, livestock pasture, and warm season grasslands. Because of their fidelity to specific burrows and spending the majority of their life on land, conserving terrestrial grassy habitat is a critical component of Crawfish Frog management. We recommend that landowners and land managers restore and/or maintain open grassy habitat when possible. To preserve the structural integrity of burrows, it is important that land managers on sites harboring Crawfish Frogs avoid tilling activities. If disking is required for installing food plots or firebreaks, we recommend that disk strips be located as far

from breeding wetlands as possible, and that the same areas be tilled year after year (i.e., permanent "disk zones") as opposed to tilling new ground. Rotational disking of new areas is strongly discouraged.

Prescribed burning is an important tool for controlling woody vegetation and purging the buildup of vegetative duff. Woody encroachment degrades open canopy grasslands which Crawfish Frogs prefer. Fire will kill exposed Crawfish Frogs, but frogs at burrows can avoid injury by retreating into their burrows. Spring burns can put adults migrating to and from breeding wetlands at risk, while summer burns may put post-metamorphic juveniles at risk. Controlled burns are currently being used to manage many grasslands harboring Crawfish Frog populations, indicating the practice is compatible with Crawfish Frog sustainability. We recognize that prescribed fire is critical to preserving the integrity of grassland ecosystems and that the environmental conditions needed to conduct burns often occur during very narrow windows of time. We suggest that, when possible, prescribed burns be conducted before the spring frog migration begins—which will vary between years and latitudinally—but in the Midwest typically is initiated by warm, spring rains from late February through April. Consultation with local herpetologists may be helpful for identifying the typical migration period for a given region. We understand that woody encroachment may present a more potent long-term threat to Crawfish Frog populations than prescribed burning, and therefore encourage strategic rotational burning to preserve these larger grassland ecosystems that are needed to sustain populations.

Prescribed grazing has become a more commonly used tool for managing grassland ecosystems and may reduce or eliminate the need for burning and tilled fire breaks. While impacts from cattle grazing are relatively understudied with this species, Crawfish Frogs are known to occupy cattle pastures and currently exist alongside cattle grazing at Atwater Prairie Chicken National Wildlife Refuge. Perhaps the greatest threat from grazing involves cattle congregating at Crawfish Frog breeding ponds when frogs are approaching metamorphosis during June and July, and increased disease. Temporary electric fencing is being used to protect Crawfish Frog breeding ponds at a grazed Indiana population. A buffer of 50 m around the breeding pond has created a cattle-free zone allowing metamorphosing Crawfish Frogs space to disperse into the surrounding grasslands before encountering cattle. This buffer also prevents cattle from degrading wetland vegetation, protects water quality, and prevents direct nutrient loading from manure. If water is needed for cattle watering, a small portion of the pond may remain partially unfenced for cattle access.

Aquatic Habitat.—Crawfish Frogs generally depend on fishless bodies of water for breeding and recruitment. If Crawfish Frog populations are to persist, fish introductions must be avoided. To prevent natural colonization of predatory fish, wetlands designed to be used by Crawfish Frogs should not be constructed in areas subjected to riparian flooding or that become connected to fish-inhabited waters through overland sheet flow during rain events. Seasonal drying of wetlands is ideal for eliminating established fish populations; however, seasonal colonization of fish in floodplain wetlands may render them unsuitable for the frogs. Small, restored wetlands equipped with water control devices are useful in replicating seasonal flooding and keeping wetlands free of fish. Crawfish Frogs prefer open-canopy wetlands and there is some evidence that sites choked with cattails (*Typha* sp.) are less suitable for Crawfish Frog tadpole development, and that wetlands containing open shallows for basking and thermoregulation are beneficial for larval development. Reducing dense cattail stands and combating invasive plants like common reed (*Phragmites*) appear critical for reproductive success. Native grasses and sedges might be preferable under some conditions to non-native grass.

Crayfish Burrows.—Crawfish Frogs have a close association with upland burrowing crayfish (e.g., *Cambarus* and *Procambarus* spp.) and depend on them for the construction of their subterranean burrows. The presence of crayfish burrows is probably the most difficult habitat feature to manage for this species. The introduction of crayfish at Crawfish Frog translocation sites has been attempted, though the efficacy of this practice is not well known. At one translocation site in Indiana, female burrowing crayfish with young were introduced to restored wetlands and, after development, juvenile crayfish dispersed and began burrowing across a restored grassland. Land managers wishing to introduce Crawfish Frogs to their properties will need to confirm the occurrence of crayfish burrows, which may be most easily found following prescribed burns. Burrow availability in Indiana ranged from 3.2 burrows per m^2 at Big Oaks National Wildlife Refuge to 0.07 burrows per m^2 at Hillenbrand Fish & Wildlife Area.

Big Picture

The persistence of other frog and salamander species in historic Crawfish Frog breeding wetlands suggests that the most important factors causing Crawfish Frog declines are occurring in the upland habitat surrounding wetlands. This is no surprise, given Crawfish Frogs can occupy burrows over a kilometer away from their breeding wetlands. Any terrestrial buffer designed to protect a Crawfish Frog population would have to encompass about a square mile around their breeding wetland.

Within this upland habitat, adult Crawfish Frog adults are resilient. In their burrows they are minimally affected by management practices that include prescribed burning, mowing, and herbicide application. Adult Crawfish Frogs are, however, severely affected by management practices that disturb the soil, such as plowing and strip-disking.

Juvenile Crawfish Frogs are especially vulnerable to most upland management activities following their mid-summer metamorphosis. Management activities during this juvenile dispersal period should be restricted for 8–10 weeks following metamorphosis, a timeframe generally encompassing late summer but will vary with latitude.

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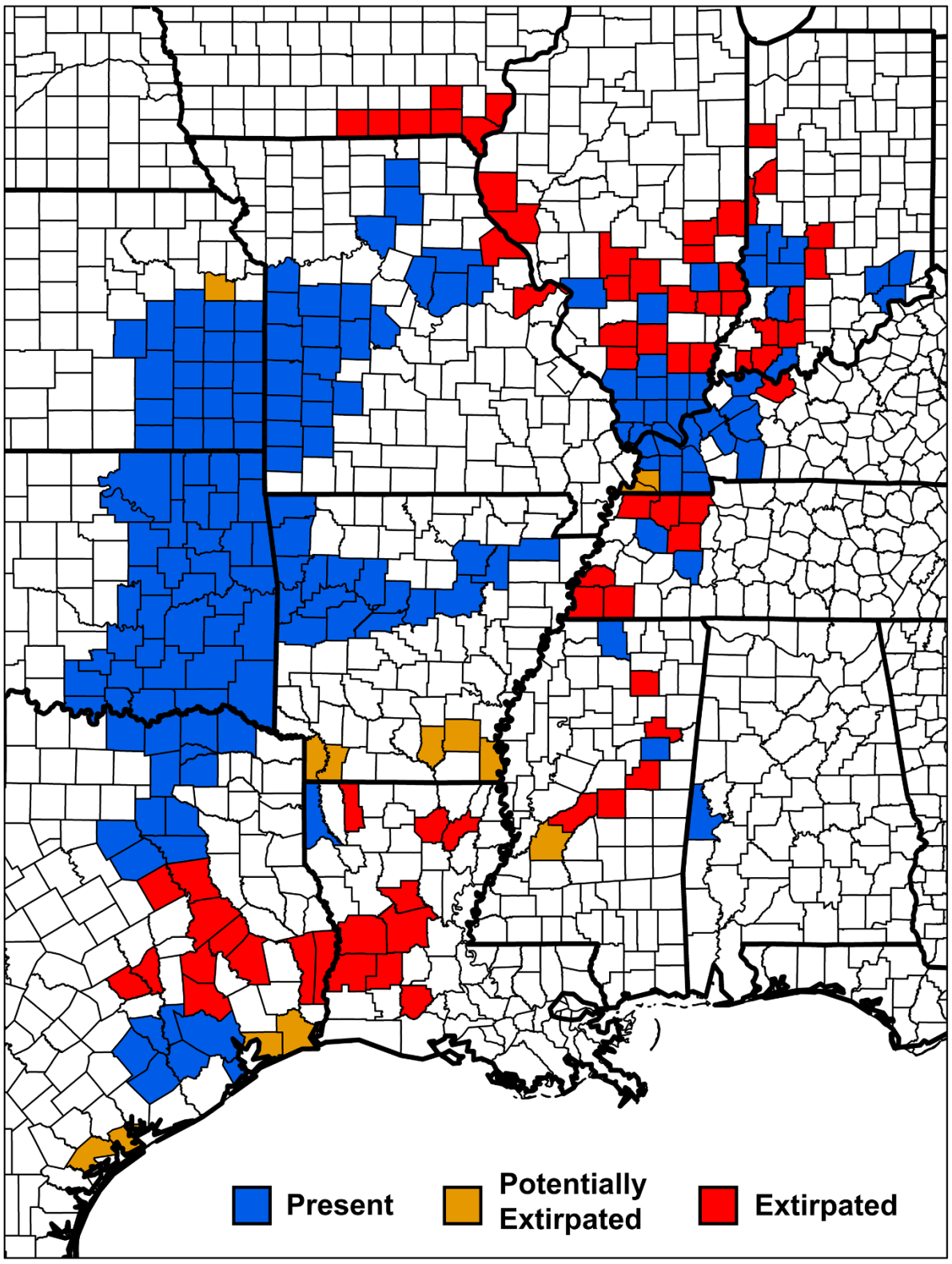

Figure 1. Current expert opinion on the county-level occupancy status of Crawfish Frogs across their range.

Figure 2. Adult Crawfish Frog in its crayfish burrow. Note the dirt “feeding platform” in front of the burrow. Also note the tight congruence between the frog’s jawline and the curvature of the burrow. Photo used courtesy of Nate Engbrecht.

Figure 3. Adult Crawfish Frog at breeding wetland. Photo used courtesy of Indiana Department of Natural Resources.