



DoD Amphibian Disease Survey From the Mountains to the Prairies—Seasonal *Bd* Responses Differ by Latitude and Longitude at a Continental Scale

Project # 10-426

Background:

Amphibians play an essential role in the ecosystems of Department of Defense (DoD) lands. The fungal disease chytridiomycosis, caused by *Batrachochytrium dendrobatidis* (*Bd*) is a major cause of many amphibian population declines and extinctions worldwide. Successful management and control of these diseases requires effective surveying to detect their presence/absence, an understanding of their distribution and frequency, and preparation to respond to outbreaks.

Objective:

The 2009 study, *Do Frogs Still Get Their Kicks on Route 66?—A Transcontinental Transect for Amphibian Chytrid Fungus (Batrachochytrium dendrobatidis) Infection on U.S. Department of Defense Installations*, provided a transcontinental transect across the central United States, holding latitude relatively constant, and showed strong spatial and temporal trends in *Bd* prevalence and intensity. The present study, using the same analytical techniques, reports on three north-south, international transects conducted at 15 DoD installations. The objectives of the investigation were to answer the following questions: 1) Is there a spatial (longitudinal and latitudinal) pattern to the presence and intensity of *Bd*? 2) Is there a temporal pattern to the presence and intensity of *Bd*? 3) To what extent are these patterns influenced by climate and geography? 4) Do our results shed light on whether *Bd* is acting as an epidemic or endemic infection across North America?

Summary of Approach:

With funding from the DoD Legacy Program, we conducted surveys along three north-south transects (West Coast, Midwest and East Coast) designed to sample for the presence of *Bd* on United States DoD installations. We sampled wetland habitats on each of the 15 installations two times in 2011 during the following seasons: 1) spring/early summer; 2) mid/late summer. We followed a non-invasive protocol for capturing and swabbing amphibians to ensure consistency in data collection and to prevent the transfer of *Bd*, if present, from one amphibian to another and from one installation to another.

Benefit:

This study sought to answer whether *Bd* is present on the surveyed DoD installations; whether sampled amphibians show signs of the disease chytridiomycosis; which amphibian species are carriers of the disease; and which amphibian species are most vulnerable to population declines from the disease (including T&E species). Answers to these questions will benefit the individual missions of the installations by 1) assisting with the management, and aid in preventing population declines, of listed species, thus avoiding new restrictions on current missions; 2) providing baseline data on the health of amphibian populations (and general health status of the ecosystem); 3) minimizing, to the extent possible, the impacts of emerging diseases that may result in population declines and thus additional regulations on currently common amphibian species; 4) assisting in defining mitigation opportunities or liabilities (e.g., areas with, or without amphibian disease detected), so that corrective actions can be taken to remove sensitive or endangered species from further contact with amphibian pathogens; and 5) raising awareness about this disease. The DoD-wide significance of this study is the minimizing of negative impacts to military readiness as a result of degrading ecosystem health (amphibian population die-offs and declines), and this study will raise awareness about the disease.

Accomplishments:

In 2011, we sampled a total of 15 DoD installations. 682 amphibians were sampled for this project, 137 (20.5%) swabs tested positive for *Bd*. We did not detect *Bd* at three installations, Mountain Warfare Training Center Bridgeport, CA, Naval Support Activity Mid-South, TN and Cape Canaveral FL. Infection rates among all other installations ranged from 4% to 59% of sampled amphibians per installation. A total of 28 amphibian species were sampled during this investigation. Of these species, 15 tested positive for *Bd*. At no point during this study did we observe dead or dying amphibians.

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Figure 1. Department of Defense installations participating in the present study.



Figure 2. Percentage of *Bd* positive samples by installation. Bases are arranged from north to south along each of the three transects in Figure 1. Left side y-axis indicates both mean annual temperature ($^{\circ}$ C, red line) and mean annual precipitation (cm, blue line).



Figure 3. Longitudinal spatial pattern of *Bd* infection rates. Note the strong tendency for the highest infection rates to occur on the west and east coasts of the United States.

Figure 4. Latitudinal spatial pattern of *Bd* infection rates. Note that installations north of approximately latitude 40° typically had higher *Bd* infection than those located below this latitude. In addition, the northern installations also had similar or greater *Bd* prevalence in the second sampling period (mid/late summer) than the first sampling period (spring/early summer).

