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LizLand: A geomorphic approach to lizard habitat modeling in the Mojave Desert

J.S. Heaton[a,*], A.R. Kiester[b], S.M. Meyers[a]

[a]Department of Geosciences, Oregon State University, 104 Wilkinson Hall, Corvallis, OR 97331-8564, USA
[b]USDA Forest Service, Pacific Northwest Research Station, Wenatchee Forestry Sciences Laboratory, 1133 N. Western Ave., Wenatchee, WA 98801-1229, USA

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Abstract

The macro-habitat preferences of three conspicuous and widely distributed species of lizards (*Aspidoscelis tigris*, *Callisaurus draconoides*, and *Uta stansburiana*) were examined across four geomorphic landforms (sandy wash, rocky wash, alluvial plain, and alluvial deposit) in the southern Mojave Desert, California. All three species were non-randomly distributed across the four geomorphic landforms. The goal of this study was to develop less ecologically generalized habitat models (LizLand) than the vegetation-based wildlife–habitat relationship models in the California Gap Analysis Program (CA-GAP). Conceptually, LizLand is a geomorphological approach to habitat modeling in arid environments. Specifically, LizLand is a series of spatially explicit habitat models that define and predict habitat for *A. tigris*, *C. draconoides*, and *U. stansburiana* in Joshua Tree National Park and the Marine Air Ground Task Force Training Command, Marine Corp Air Ground Combat Center. LizLand models resulted in higher resolution habitat models with minimal reduction in model accuracy. These models more accurately captured the complexity of the Mojave Desert ecosystem and offered greater ecological resolution in identifying habitat in contrast to the CA-GAP models.

Keywords: Mojave Desert; Geomorphic landforms; Habitat model; *Aspidoscelis tigris*; *Callisaurus draconoides*; *Uta stansburiana*

*Corresponding author. Department of Geography/154, University of Nevada, Reno, NV 89557-0048, USA. Tel.: +1 775 784 8056; fax: +1 775 784 1058.
E-mail address: jheaton@gis.unr.edu (J.S. Heaton).

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1. Introduction

Reptiles and amphibians have often been excluded from consideration in habitat evaluation and management (Clawson et al., 1984) although they comprise 30% of the North American native terrestrial vertebrates (Bury et al., 1980), and 19% of California's desert terrestrial vertebrates (Cornett, 1987). Exceptions include species listed under federal or state endangered species acts such as *Gopherus agassizii* (Anderson et al., 2000; Aycrigg et al., 2004) and *Uma inornata* (Barrows, 1997). In addition, while general habitat requirements are known for many reptiles and amphibians, little quantitative work has been done to evaluate habitat quality or suitability (Baltosser and Best, 1990), especially in arid environments. Exceptions include the desert riparian island study by Szaro and Belfit (1986), the Chihuahuan Desert "natural" versus herbicide modified landscape study by Peterson and Whitford (1987), and the undisturbed/disturbed mesquite study by Germano and Hungerford (1981).

In general, research on lizards in the arid South-west has focused primarily on comparative, demographic, and life history studies. When lizard habitat or space niche dimension has been investigated, the focus has been on micro-habitat niche requirements (Pianka, 1975, 1986, 1993). For example, much of Pianka's (1966, 1967, 1973, 1986), and Pianka and Parker (1975), as well as others (Waldschmidt, 1980; Waldschmidt and Tracy, 1983; James, 1994), has advocated using indices of spatial heterogeneity to predict and/or describe habitat for desert reptiles. The focus has been primarily on vegetation structure and sun and shade space, not vegetation composition or geomorphic landforms. More recent attempts have centered on vegetation structure, density and volume, substrate size, and density of rodent burrows (Smith et al., 1987; Baltosser and Best, 1990; Shenbrot et al., 1991; Martin and Lopez, 1998). Vegetation composition has been shown to be important in controlling the distribution of some desert reptiles, especially at the local and/or micro-habitat levels. For example, within the southern portions of its range *Xantusia vigilis* has been closely associated with Joshua trees and other *Yucca* sp. (Pianka, 1986). However, at higher elevations in the Mojave Desert, *X. vigilis* has been shown to exploit small rock micro-habitats (Morafka and Banta, 1972).

Aspidoscelis tigris is a habitat generalist occurring in many different vegetation, soil, and geomorphic habitats in the Great Basin, Mojave, and Sonoran deserts. This active, widely foraging species (Mitchell, 1979; Anderson, 1993) prefers open habitat (Vitt and Ohmart, 1977b). A "frequent mover," *A. tigris* spends little time in one place. It rarely flees far when threatened (Anderson, 1993), usually running to the nearest bush where it begins foraging again almost immediately. *A. tigris* spends the majority of its time foraging by digging and rummaging through detritus (Peterson and Whitford, 1987; Anderson, 1993).

Callisaurus draconoides is a speedy, sit-and-wait insectivorous predator that prefers open, unbroken terrain (Pianka, 1986; Bulova, 1994). When approached, *C. draconoides* curls its tail over its hindquarters and back exposing a bold black and white zebra pattern underneath, and wiggles its tail from side to side (Pianka and Vitt, 2003). If approached further, it resorts to extreme speed estimated at up to 20–30 km/h, and long zigzag runs (Dial, 1986; Hasson et al., 1989). *C. draconoides* does not avoid rocks (Pianka and Parker, 1972; Tanner and Krogh, 1975; Vitt and Ohmart, 1977a; Stebbins, 2003), though rocky environments may not always provide ideal conditions.

Uta stansburiana is a sit-and-wait, insectivorous predator that prefers very broken, spatially heterogeneous terrain. This species is most often associated with rocks, but is also