

Integrating freshwater conservation and pastoral stewardship in Mediterranean rural landscapes: the “biodiversity shepherd” initiative

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The biodiversity crisis disproportionately affects freshwater biota, with amphibians representing the most threatened vertebrate group globally due to habitat loss, emerging diseases, and climate change. In Mediterranean rural landscapes, many aquatic organisms depend on small, shallow, often temporary water bodies increasingly vulnerable to desiccation. The Apennine yellow-bellied toad *Bombina pachypus*, an Italian endemic of high conservation concern, exemplifies this vulnerability. Although historically associated with natural ephemeral ponds, the species has long exploited artificial water bodies such as cattle troughs and traditional watering sites. These structures, built for free-ranging livestock, can function as permanent, predator-poor breeding habitats and refugia within increasingly dry landscapes, supporting *B. pachypus*, other amphibians and aquatic invertebrates. However, the abandonment of pastoral activities is leading to the disappearance or neglect of these small “safe island” habitats, exacerbating species decline. To address this, we present an integrated conservation initiative developed within the Appennino Lucano Val D'Agri Lagonegrese National Park (Southern Italy) where pastoralism and artificial watering sites remains widespread. Spatial surveys identified priority areas where drinking troughs sustain *B. pachypus* populations and associated freshwater assemblages, while genetic screenings informed the selection of source populations for future restocking. Selected troughs were restored or modified to improve ecological suitability while preserving their primary function for livestock. The key innovation is the formal recognition of the “biodiversity shepherd” role: local pastoralists who, through direct involvement and economic incentives, contribute to habitat maintenance, report ecological changes and provide continuous monitoring. This approach transforms pastoral infrastructure into conservation infrastructure and the routine, landscape-scale presence of shepherds into an effective early-warning system. Using *B. pachypus* as an umbrella species, this project delivers broader benefits for freshwater biodiversity, showing that conservation can align with rural livelihoods and that traditional pastoralism can help maintain freshwater habitats and multifunctional cultural landscapes.