LIDAR-based Fish Passage Assessment of 350 Road-Stream Crossings in Nine Lower Delaware Wild and Scenic River Municipalities

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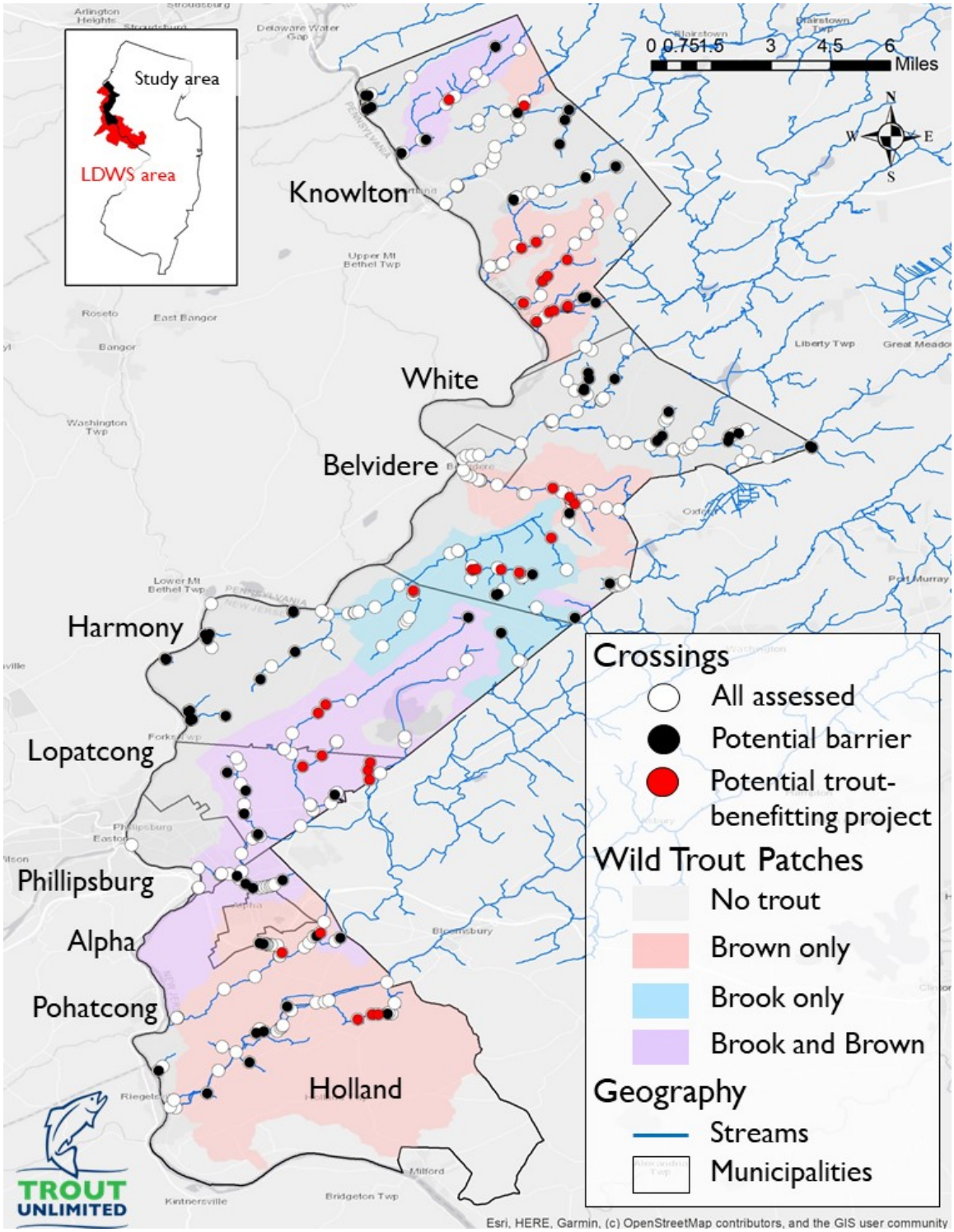

SUMMARY

Roads cross streams at ~40,000 locations in the Delaware River Basin. Where these crossings are not properly designed for the streams they carry, aquatic and terrestrial organism passage can be blocked, roads may flood, and erosion rates likely increase. Therefore, identifying and upgrading problem crossings can benefit both fish and wildlife and human communities. However, field-assessing road-stream crossings for fish passage and flood resiliency, while very valuable, can be costly and time-consuming in the initial phase of project development. For this Lower Delaware Wild and Scenic (LDWS) grant project, Trout Unlimited evaluated a computer-based approach (high resolution LIDAR) to increase the efficiency of initial road-stream crossing assessment for fish passage. We remotely estimated a common surrogate of fish passage—stream surface elevation drop from above to below the road-stream crossing— at 76 crossings in northwest New Jersey where we also had field-measured estimates of fish passage. We then applied this method to 350 crossings in nine New Jersey municipalities in the LDWS region. When tested against field assessments the computer-based approach correctly identified 100% of significant and severe barriers to fish passage as ranked by the North Atlantic Aquatic Connectivity Collaborative's scoring system. LIDAR-measured elevation drop also explained significant variation in field-measured elevation drop ($R^2 = 0.85$; $F_{(1,64)} = 364.5$; $p < 0.001$), and computer and field measures differed by a mean of 0.22 feet. Moreover, we estimated that this method saved approximately $24,255 (87% savings) relative to traditional field assessments when applied in the LDWS, even when budgeting for final field surveys of computer-identified barriers to fish passage. The accuracy and cost of this approach strike a balance between those of field surveys and coarse landscape-based computer models and are likely acceptable for many ecological applications. However, the method should be tested against field data when applied in new geographic regions or with new digital elevation datasets. **Of the 350 crossings evaluated in the LDWS, 107 were identified as potential barriers to fish passage, 62 of these were in wild trout waters where our organization prioritizes its work, and 34 of these are potentially ecologically significant given their position in the stream network. We recommend more detailed field assessments of condition, fish passage, terrestrial wildlife passage, and flood resiliency at these 34 crossings. Replacing some of these structures with fish-friendly designs either proactively or when road managers determine maintenance costs outweigh the replacement cost of a given structure will likely benefit people, wildlife, and fish populations.**