



Developing a top-down land-use management procedure for fish habitat enhancement

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Land-use change can influence stream ecosystem and alter instream physical, chemical and biological habitat. For example, urbanization usually contributes to increasing sediment loadings to streams and inappropriate agricultural management results in degradation of stream water quality. Watershed model is an effective way to forecast the watershed response to different land-use change scenarios. We developed a top-down approach from the watershed scale to the microscale by combining the habitat model, land-use change model and watershed hydrological model. This approach can assist land-use planner to make optimal decisions with fish habitat enhancement. The study was conducted in Datuan Stream, located in Tamsui District, New Taipei City and the target species is monk goby (*Sicyopterus japonicus*). The spatially explicit land-use change model, CLUE-s was first applied to project several future land-use scenarios and the Soil and Water Assessment Tool (SWAT) was then applied to simulate streamflow for different land-use scenarios. The simulated streamflow were used as input data for simulating river habitat, where Habitat Suitability Analysis is one of the most important processes. The relationship between target species and multiple environmental factors of habitat was first developed using the Habitat suitability index (HSI). In this study, we used fish presence probabilities for each velocity and water depth to establish different HSI functions under 4 flow conditions (slack, riffle, pool and run) using genetic programming (GP). The physical habitat model, River 2D, was then applied to simulate the river section and calculate weighted usable area (WUA). Based on the WUA results for different land-use scenarios, we further evaluated the relationships between WUA and land-use/landscape patterns using a spatial pattern analysis program, Fragstats. The results showed that by using the habitat model for classified flows, the habitat suitability curve which reflects different activities of fish (ex: spawning, preying) is more practical. Moreover, the proposed land-use management procedure can be useful for future land-use planning with fish habitat conservation.