Poster #227

# Road erosion in dry and wet tropical settings of the Northeastern Caribbean

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## Background

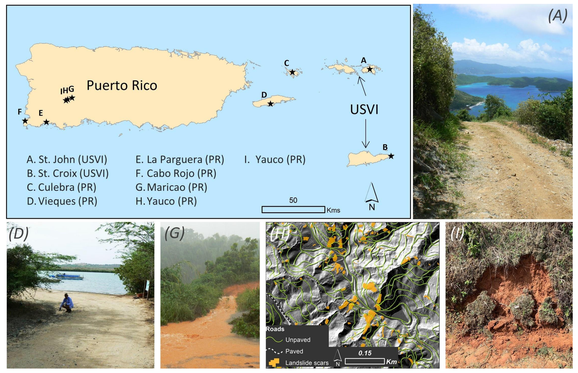
Erosion is a key concern in the Caribbean in part because sediments can reduce water reservoir capacity and may affect marine habitats such as coral reefs. Research conducted since the 1990s has shown that incorporating roads into sediment budget analyses is essential in understanding sediment dynamics in the region.

## Research Questions

- What are the *hydrologic impacts* of roads across various scales?
- What are the impacts of roads on *surface erosion* and *shallow landsliding*?

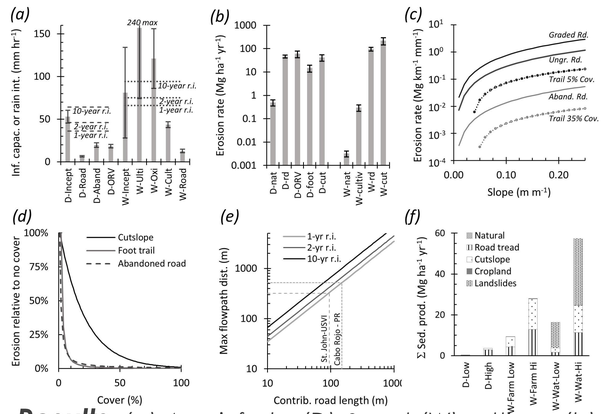
## Methods and Materials

- **Hydro**: Guelph, runoff plots, portable flumes, unit hydrog. & kinematic wave modeling, crest gages, stream discharge
- **Erosion**: runoff plots, sediment traps, graph theory GIS modeling
- **Landslides**: aerial photos, lidar dem, frequency ratios

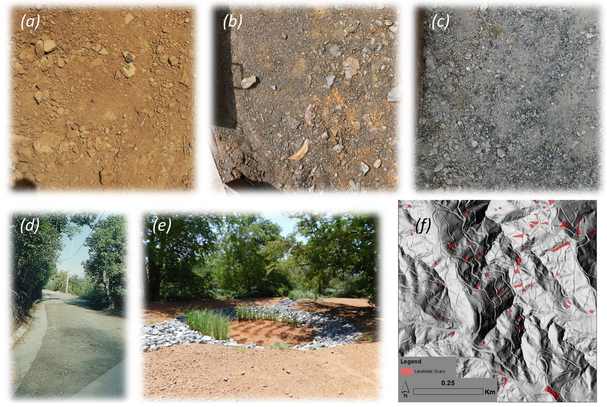



***Study sites***. *(A1 & 2) Coral Bay, STJ-USVI; (B) East End, STX-USVI; (C) Culebra-PR; (D) Mosquito Bay, Vieques-PR; (E) La Parguera-PR; (F) Cabo Rojo-PR; (G) Maricao-PR; (H) Hda S. Carlos, Yauco-PR; (I1 & 2) Hda Candelaria, Yauco-PR.*


***Methods***: *(A & B) Sed. traps; (C) Runoff plot; (D) Guelph; (E) Rain simulations; (F) Det. pond survey; (G) GIS mapping; (H) Flumes; (I) Landslide mapping & repeated lidar digital elevation model analyses*




***Results***: *(a) Avg inf. dry (D) & wet (W) settings. (b) Erosion various surfaces. (c) Erosion vs. slope (d) Erosion relative to 0% cover vs. veg. cover. (e) Max flow dist. below road drain (f) Road- and non-road-related sources at the farm and watershed scales.*



***Discussion***. *Surface texture of unsurfaced (a) and gravel-covered (b-c) roadways in coffee farms in PR. (d) Road drainage improvements at Maho Road in St. John included insloping and the construction of a cemented inside ditch and cross-drains. (e) Sediment detention pond used to reduce connectivity (Cabo Rojo-PR). (f) Preliminary mapping of landslides in the Yahuecas Watershed in PR showing their close proximity to unmapped farm roads.*

## Results

- **Hydro**: Rain threshold for HOF ~2-6 mm; infiltration capacity ~10-40% undisturbed
- **Erosion**: f(slope$^{1.5}$, road drainage pattern, grading frequency, traffic/usage, rain, vegetation cover, practices); Σerosion watershed = f(rd density)
- **Landslides**: ~ ¾ of mobilized sediments within 5 m of roads; frequency ratios > 1

## Future work

- **Hydro**: connectivity, surface and subsurface stormflow interception
- **Erosion**: empirical evidence of road to stream & coast sediment connectivity; effectiveness of management practices;
- **Landslides:** improved and management-relevant understanding of road impacts on slope stability

## Conclusions

- **Hydro**: HOF *contributing areas*
- **Erosion**: $10^1$ – $10^4$ faster than undisturbed; >90% farm and watershed sediments
- **Landslides**: proximity to roads and slope (30-60°) are key factors

## Key References

Ramos Scharrón & LaFevor (2018). Effects of forest roads on runoff initiation in low-order ephemeral streams. *WRR, 54*(11), 8613-8631. 10.1029/2018WR023442

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