Stream condition in the Lake Tahoe Basin using the River Invertebrate Prediction and Classification System (RIVPACS)

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## Background



Designed to assess the Region's level of compliance with a broad range of environmental standards

## **Environmental Indicators**

- Lake Tahoe and Small Lakes
- Stormwater
- Air Quality
- Forest Vegetation and Fuels
- Land Use and Impervious Cover
- Socioeconomic
- Streams Pollutants, Hydrology & Bio-integrity



## Benthic Macroinvertebrates (BMIs) as Indicators

- Found in nearly all streams (ubiquitous)
- Have a wide range of tolerances
- Reflect conditions over time (not a snapshot)
- Taxonomy is fairly well-known





# **Study Objectives**

- Develop data evaluation methods for benthic macroinvertebrate data in the Tahoe Basin
- Use methods that are comparable to other regions (Statewide RIVPACS)
- Analyze data from 2009 & 2010 to examine status of streams in Tahoe Basin



## **Study Sites**

- 85 sites (10 duplicates)
- 29 watersheds
- Sampled June-Sept of 2009 & 2010
- 54 in CA (TRPA)
- 31 in NV (NDEP)

# Kilometers 0 9 18 27 36

### **Stream Sampling**



Sampling for benthic macroinvertebrates on Trout Creek

#### Methods

# River Invertebrate Prediction & Classification System (RIVPACS)

- Why RIVPACS?
- Predictive model based on features unaffected by human stressors (e.g., latitude, watershed area, geology, temperature and precipitation)
- Ratio of <u>observed</u> taxa at a site relative to the <u>expected</u> taxa for a reference site (O/E)
- Score of 1.0 would indicate same taxa as expected for a reference site

## Thresholds for impairment

Rating	Range of O/E (P>0.5)	# s.d.
Excellent	0.81 – 1.19	1
Good	0.62 – 0.81	2
Degraded	0.43 – 0.62	3
Very degraded	< 0.43	>3

#### Results

#### Histogram of 2009 & 2010 data





## Map showing O/E threshold categories

#### <u>Legend</u>

O/E (P>0.5) ranges

- < 0.43 (very degraded)</p>
- O 0.43 0.62 (degraded)
- O 0.62 0.81 (good)
- > 0.81 (excellent)

# Kilometers 9 18 27 36

### High suspended sediment and nutrients in Upper Truckee and Trout Creek



Source of figure: Tahoe Environmental Research Center (2011) "State of the Lake Report" Data from Lake Tahoe Interagency Monitoring Program (LTIMP)



Lake Tahoe **Impervious** Cover

> Impervious cover categorized by Celeste Melosh

#### %Impervious Cover (1 km radius upstream of sampling site)



#### %Agriculture and %Urban Land (5 km radius upstream of sampling site)



## Site level features

- Perennial versus intermittent
- Bedrock versus gravel/sand
- Local impacts such as bank erosion



#### Unnamed headwaters trib of Upper Truckee O/E score = 0.87 ("excellent")



#### Site on Meeks Creek O/E score = 0.73 ("good")



#### Site on Cold Creek O/E score = 0.43 ("degraded")



#### Site on Trout Creek near its mouth O/E score = 0.2 ("very degraded")



## Summary

#### • What we found

- Landscape level factors impact stream communities
- About ½ sites were in good shape, ½ degraded

#### Next steps

- Identify weaknesses of RIVPACS to better distinguish sites that don't fit the model well (intermittent and bedrock) with those that are actually degraded
- Influence of high flow events (2009-10) that may cause scour and site-level habitat features

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### **Questions?**

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Madden Creek





#### Road Density (5 km radius upstream of sampling site)

