

# Active Learning in the Earth Sciences

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## What is Active Learning?

- Definitions.
  1. Learning by doing
  2. Enhance understanding by reflection on practical activities
  3. The Kolb Learning Cycle
    - Experience, Reflect, Generalize, Test
    - => Understanding

## Why Implement Active Learning?

- Excite & engage students
- Increase skill level
- Enhance “deep” learning & understanding
  - Connections
  - Complexity of natural systems
  - Geographic diversity

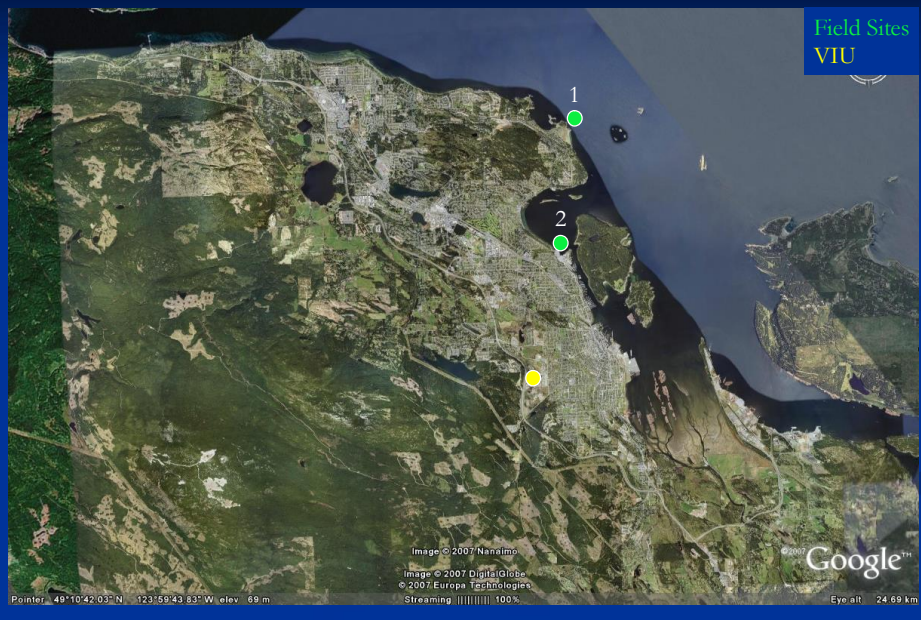
## Some Ideas for Active Learning

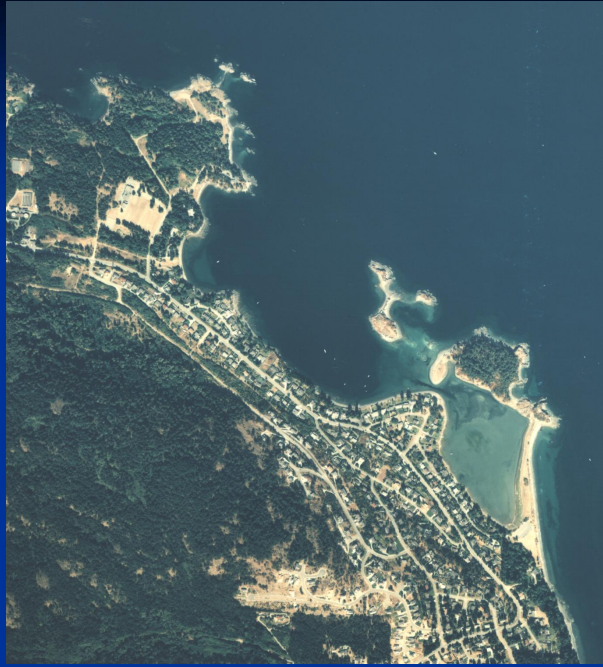
- Strategies used in hydrology, geomorphology & GIS courses
- Utilize common skills in Earth Science
  1. **Air photo interpretation** to enhance fieldwork
  2. **Fieldwork** to help understand the evolution of natural systems
  3. **Integrate study of many locations** to appreciate geographic diversity

# 1) Air photo interpretation to enhance fieldwork

- Learning goals
  - Experience with air photo interpretation
  - Augment information collected during fieldwork
- Description of learning activity
  - Ask questions of field site before visit & answer from air photo interpretation
  - Do fieldwork & ask same questions
  - Students reflect on both sets of answers

## Nanaimo Region





### Site 1 – Pipers Lagoon

- ID materials
- Profile
- ID landforms & explain origin
- Active processes
- Describe change



Pipers Lagoon



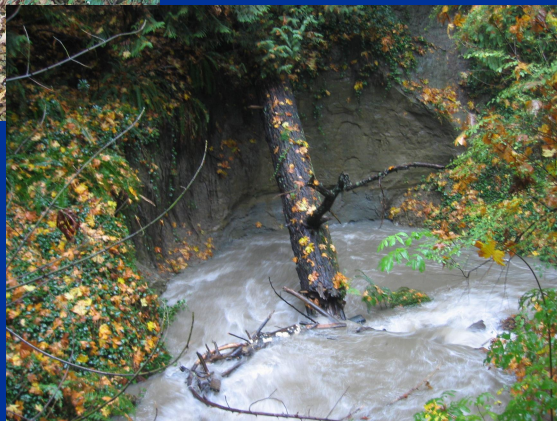
**Site 2 – Departure Bay & Beach Estates Park**  
ID materials, Profile, ID landforms & explain origin,  
Active processes & Describe change



Departure Bay



Beach Estates Park



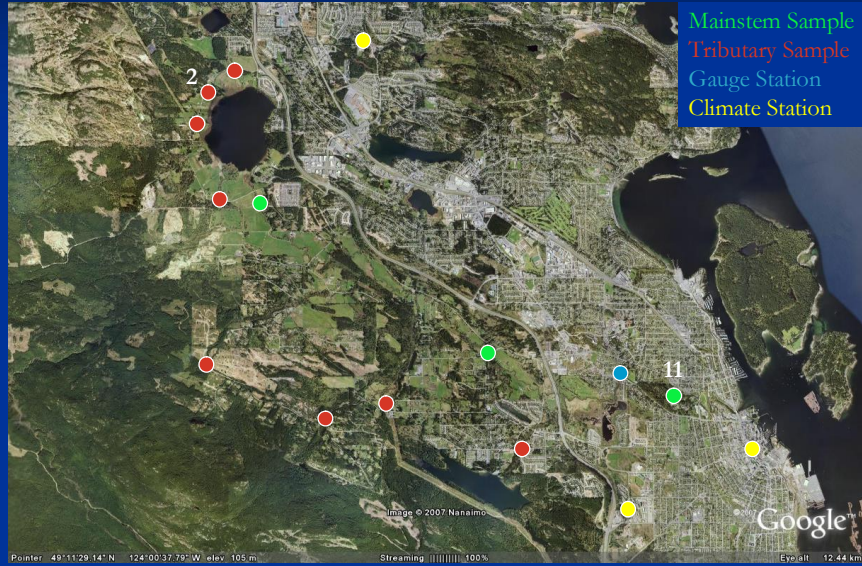
## 1) Summary

- Valuable experience with API
- Integrate API with fieldwork
- Generalize what data can be collected by each activity

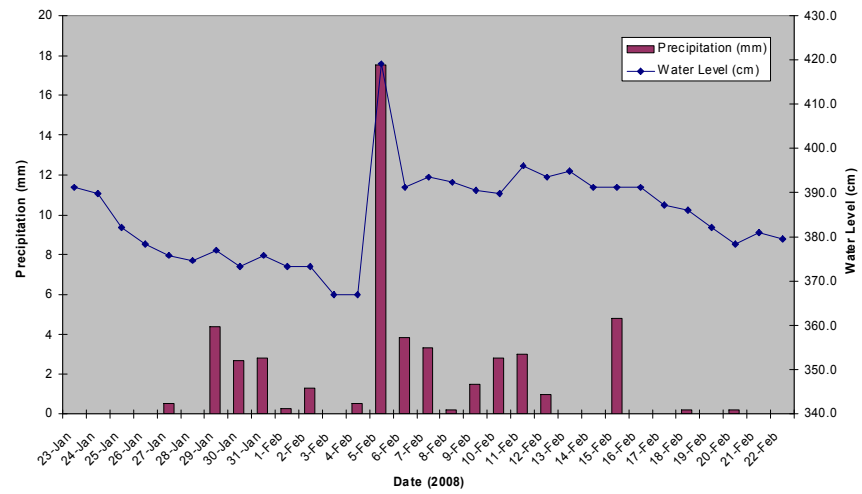
## 2) **Fieldwork** to help understand the evolution of natural systems

- Learning goals
  - Appreciate complex response of natural systems to changing environment (e.g. flood hydrograph)
  - Experience of sampling design, data collection and processing, and interpretation
- Description of learning activity
  - Class designs sampling procedure
  - Collect data in small groups with one or more sites
  - Reflect on their data collection & interpretation
  - Integrate other group data to understand system response

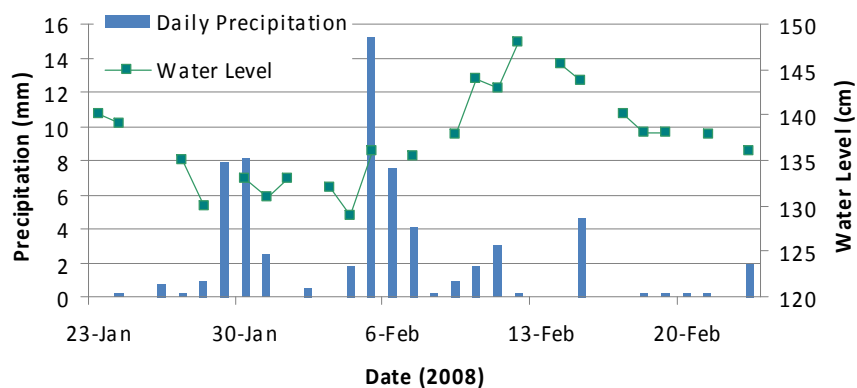
# Millstone River Watershed



Hydrograph at Site 11



## Hydrograph at Site 2



## 2) Summary

- Design and set up a sampling procedure
- Experience data collection
- Evaluate data integrity and quality
- Generalize data to understand complex response



### 3) Integrate study of many locations to appreciate geographic diversity

- Learning goals
  - Assess data at a single location
  - Integrate data at many locations
- Description of learning activity
  - Lab activity with each student assigned a location
  - Find and interpret temporal data from “their” location
  - Discuss local spatial patterns in small groups
  - Reflect on regional spatial pattern as a class
  - Use animations to reinforce learning

## Hydrology of Canada



### 3) Summary

- Students have “ownership” of their location
- Generalize local data into regional understanding
- Animations used as a learning tool
- Many datasets exist that could be animated

### Conclusions

- Active learning engages students
- 1) **Air photo interpretation** to enhance fieldwork
  - Augments fieldwork with additional information
- 2) **Fieldwork** to help understand the evolution of natural systems
  - Experience designing and implementing a field project
- 3) Integrate study of many locations to appreciate of geographic diversity
  - Determine geographic patterning

## Students in Action

