A New Look at Surface Water Quality In Island County

Background

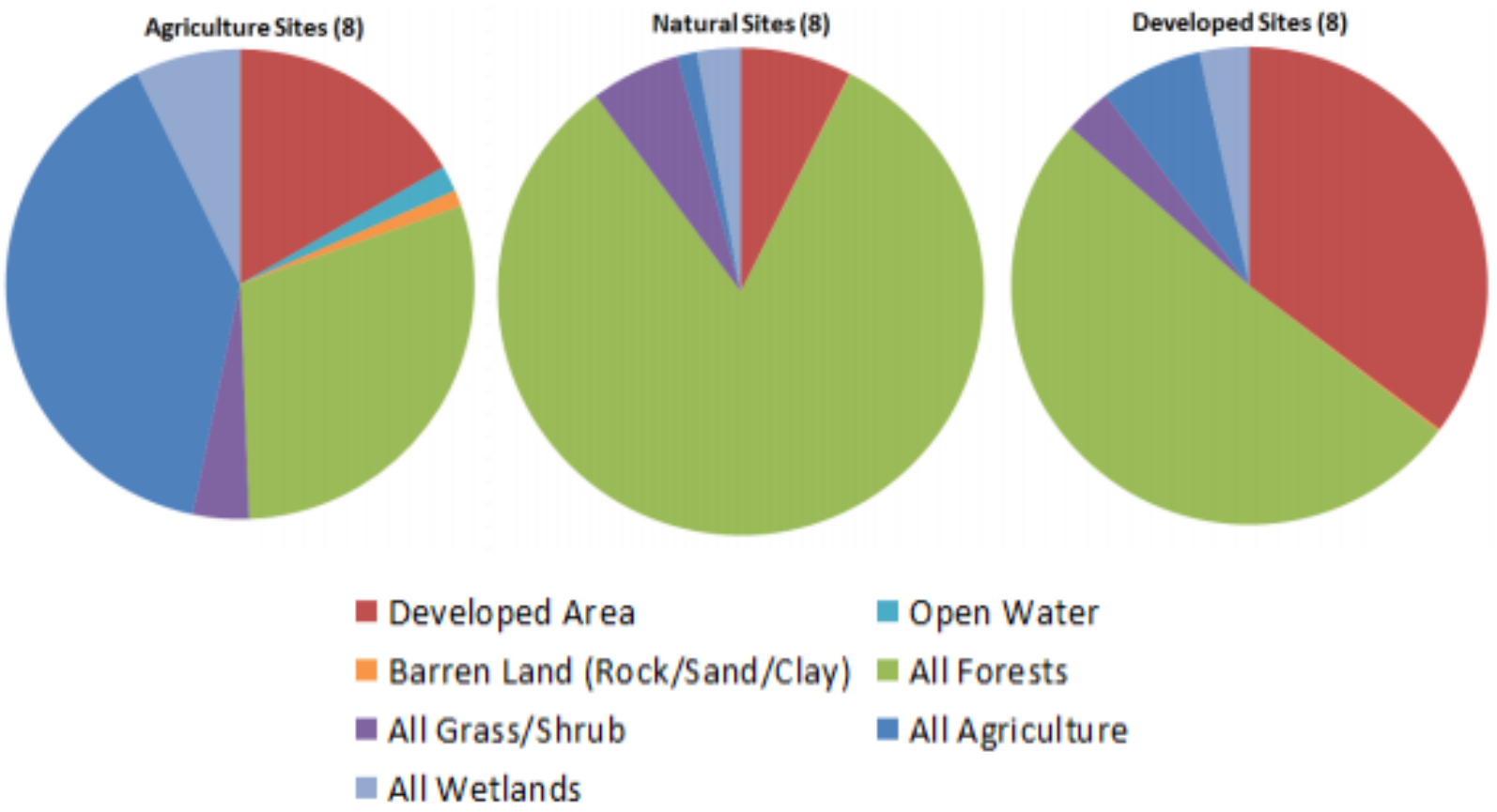
- **Island County monitored and reported water quality for three Land Types - Agriculture, Developed, and Natural – over five years (2007-2011)**

- **Monitoring measured:**

1. **Fecal Coliform**
2. **Conductivity**
3. **Ortho-phosphates**
4. **Nitrates**
5. **Guage (water depth)**
6. **Discharge (streamflow)**
7. **Temperature**
8. **pH**
9. **Dissolved oxygen**
10. **Turbidity**

Land Types: Agricultural, Developed, and Natural

1. **Land use practices across the County are diverse and create a variety of impacts.**



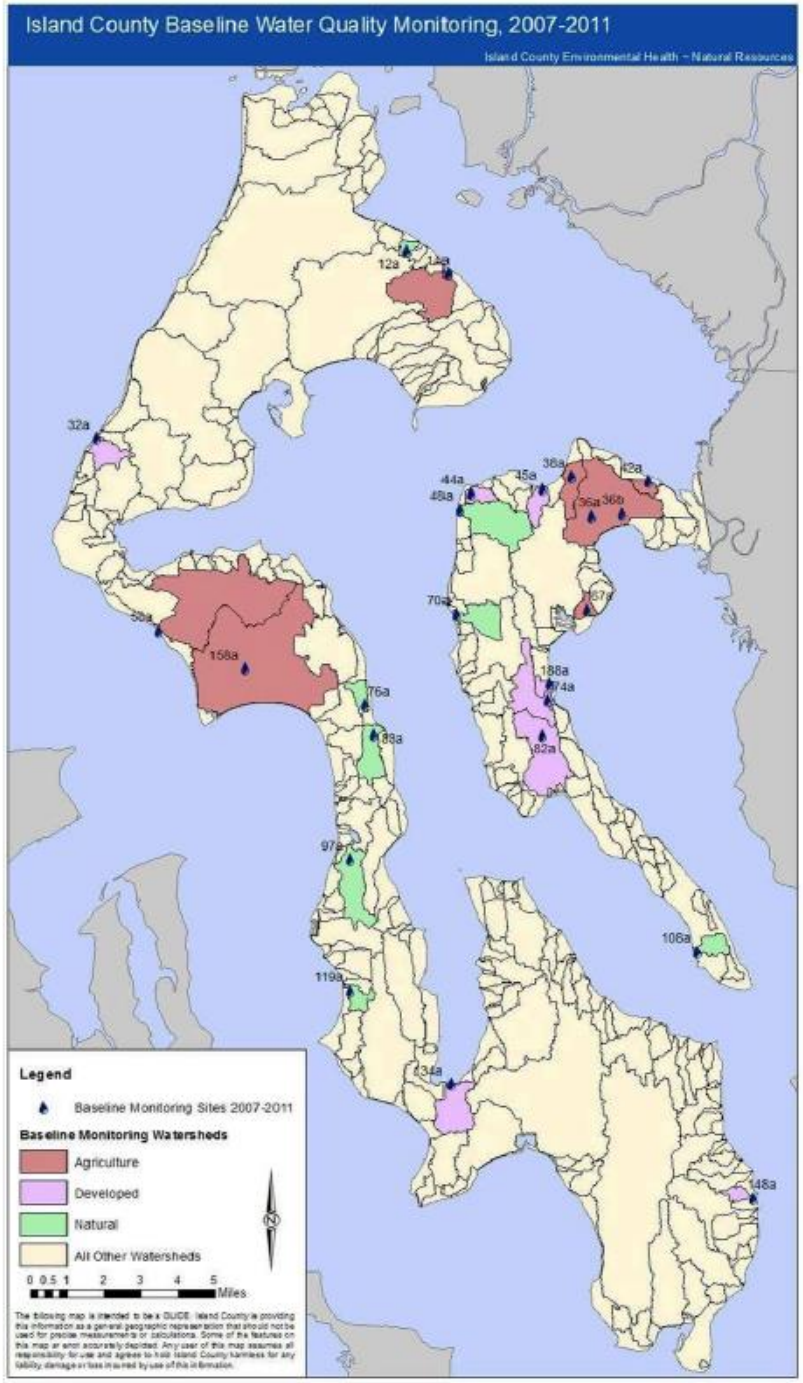


Figure 1. Baseline water quality monitoring sites, 2007-2011.

Geomean Computation

- **For each stream for each year**

  1. **Compute Geomean = $(X_{Jan} * X_{Feb} * \ldots\ldots\ldots * X_{Dec})^{1/12}$**

  2. **Compare to water standard**

     - 100 colonies/ 100mL primary contact recreation* (PCR)
     - 50 colonies/ 100mL extraordinary waters PCR

- **Combine years**

*** High degree of bodily contact with water such as swimming, wading**

Grading the Streams
From Island County Surface Water Monitoring Program 2007-2011

86 WQI score above 80, which is considered of low concern

67 WQI score between 40 and 80, which is of moderate concern

38 WQI score below 40, which is of high concern

Met fecal coliform standards during all 5 years

Exceeded fecal coliform standards during one or two of the 5 years

Exceeded fecal coliform standards during three or more of the 5 years

WQI - Water Quality Index

Water Quality Results for Years 2007 - 2011

Site name	Land Use	5-Year WQI Score	Meets Fecal Coliform Standards?	Improving Trends[2]	Worsening Trends[2]
12a – Deception Bog	Natural	n/a[1]		-	Increasing conductivity
76a – Willow Pond	Natural	n/a[1]		Increasing dissolved oxygen	-
83a North Bluff Creek	Natural	79		Decreasing turbidity Decreasing orthophosphate	Decreasing dissolved oxygen
97a – Smuggler's Cove	Natural	72		Decreasing turbidity Decreasing orthophosphate	Increasing acidity
119a – South Whidbey State Park	Natural	76		Decreasing turbidity Decreasing orthophosphate	Increasing temperature Increasing nitrate
48a – North Sunset Drive	Natural	69		Decreasing turbidity Decreasing nitrate Decreasing orthophosphate	-
70a – Sunset at West Camano	Natural	88		Decreasing fecal coliform Decreasing orthophosphate	Increasing acidity
108a – South Camano Drive	Natural	83		Decreasing orthophosphate	Increasing conductivity
14a – Green Road	Agriculture	49		Decreasing conductivity Decreasing orthophosphate	Increasing acidity Increasing turbidity
36b – Lutheran Church	Agriculture	41		Decreasing nitrate	Decreasing dissolved oxygen
58a – Ebey's Landing	Agriculture	1		-	-
158a – Wanamaker Road	Agriculture	34		-	Increasing conductivity Decreasing dissolved oxygen

Water Quality Results for Years 2007 - 2011

Site name	Land Use	5-Year WQI Score	Meets Fecal Coliform Standards?	Improving Trends[2]	Worsening Trends[2]
42a – Utsalady at Good Road	Agriculture	45	🔴	-	-
36a – Terry's Corner	Agriculture	63	🔴	Decreasing nitrate	Increasing temperature
38a – Utsalady at Arrowhead Road	Agriculture	85	🔴	Decreasing turbidity	Increasing acidity
67a – Sunrise at Iverson Road	Agriculture	72	🟡	Decreasing nitrate Decreasing orthophosphate	Increasing temperature
32a – West Beach	Developed	23	🔴	Decreasing orthophosphate	-
74a – Cavalero at Country Club	Developed	62	🔴	Increasing dissolved oxygen Decreasing orthophosphate	Increasing turbidity
148a – Berg & Conrad	Developed	50	🔴	Decreasing orthophosphate	Increasing nitrate
44a – Rocky Point	Developed	37	🔴	Decreasing turbidity Decreasing fecal coliform Decreasing orthophosphate	Increasing conductivity Increasing nitrate
45a – North Camano at Nellie	Developed	44	🔴	Decreasing orthophosphate	Increasing acidity
188a – Cavalero at Simonson Place	Developed	72	🔴	Decreasing turbidity Decreasing fecal coliform Decreasing orthophosphate	-
134a – Freeland Park	Developed	27	🔴	Decreasing temperature Increasing dissolved oxygen Decreasing orthophosphate	Increasing acidity
82a – Bonnie Lane	Developed	71	🟡	Decreasing orthophosphate	-

General Observations

- **There is a lot of red – surface water quality is not meeting standards**
- **Only Natural Areas meet fecal coliform standard**
- **Island County has spent considerable resources trying to identify sources of pollution**

    1. County found several failed on-site systems over 10 years
    2. But even after correction - water quality continues to fail standards

A More Recent Study

- **Effectiveness Monitoring Case Study for Island LIO - May 2014**

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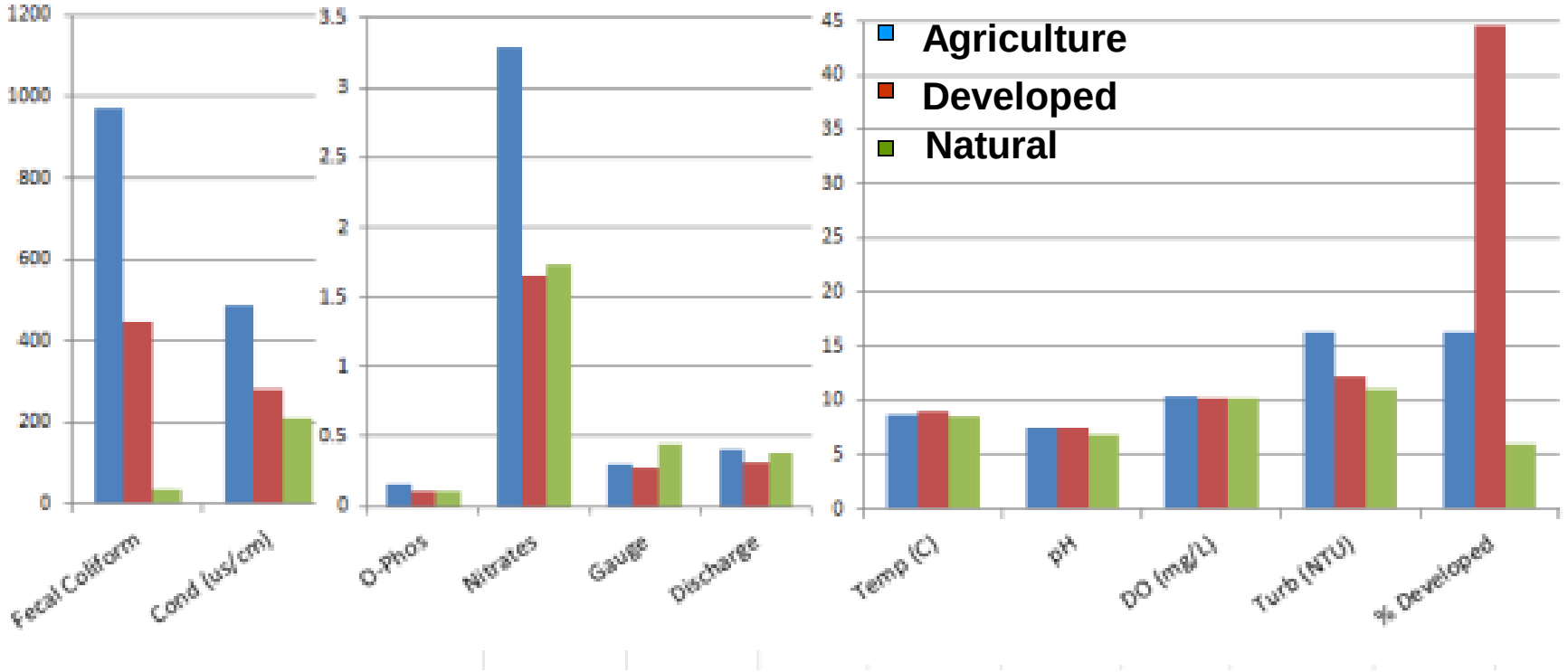
Land Usage Types and Water Quality
Average Values



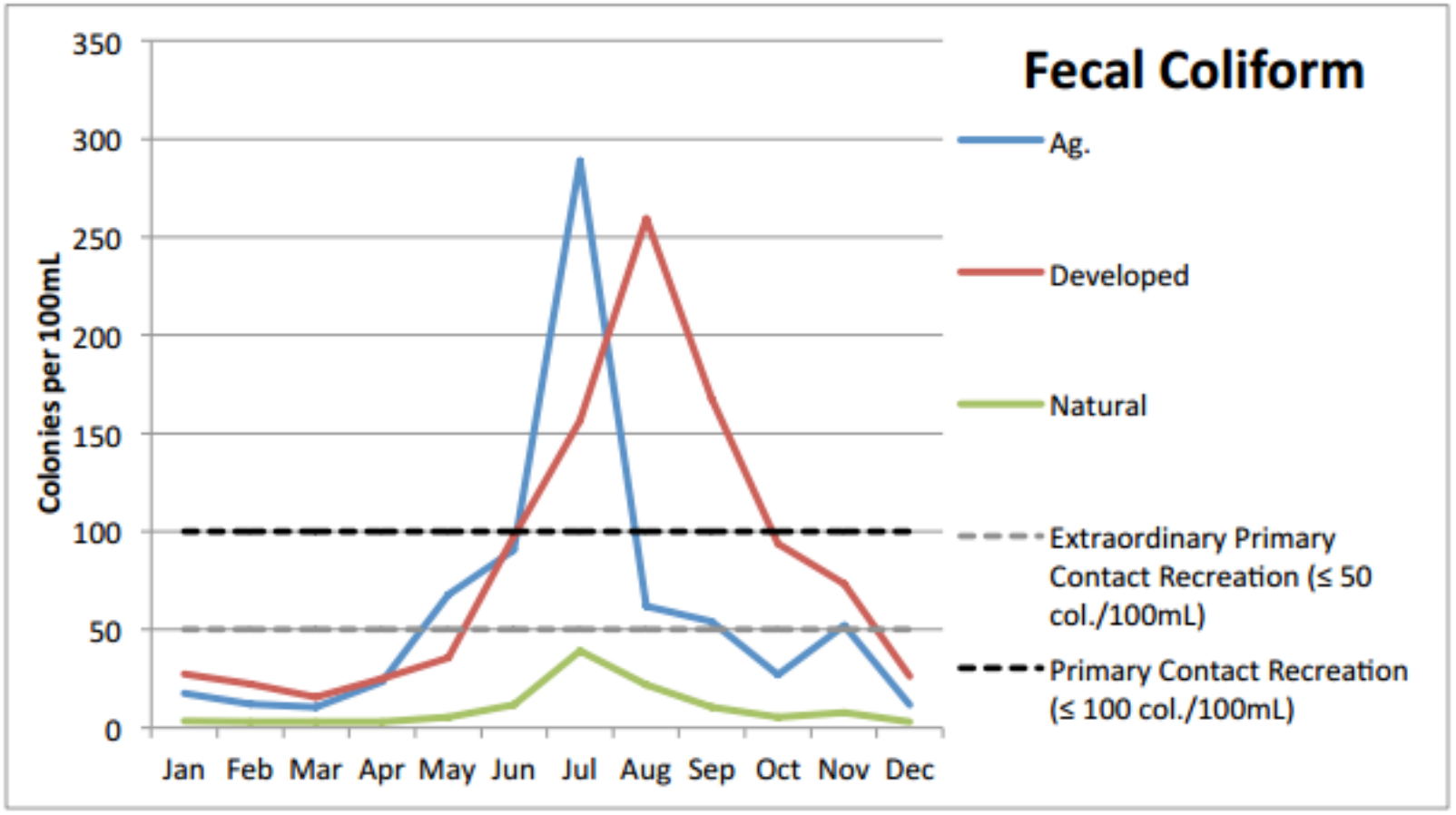
New Geomean Computation - Ensemble

- **Calculate geomean for <u>each</u> month over all years (2007-2011)**

$$\text{Geomean}_K = (X_{2007} * X_{2008} * X_{2009} * X_{2010} * X_{2011})_K^{1/5}$$

- **Plot geomean for each month**

Ensemble Monthly Fecal Coliform Geomean
Years 2007 - 2011



What Does Ensemble Monthly Geomean Show?

- **Natural area streams meet water quality standard**
- **Agricultural-area streams meet the water quality standard except for July**
- **Developed-area streams meet the quality standard except between June to October**
- **And during wet months water quality meets the standard for all areas**

Interpretation of Ensemble Monthly Geomean

- **Fecal amounts fairly constant over a year**

  - **Number of people, farm animals, pets, wild mammals and birds fairly constant over a year**
    - **So, amount of fecal material entering streams in dry season likely same as wet season**
  - **Amount of water in streams not constant at all**

- **Original approach leads to misleading conclusions**

- **Perhaps water quality standard not meaningful when little or no stream flow**

Second Part of Water Quality Standard

- **Not more that 10% of samples exceeding twice the standard for the geometric mean**

- **Even natural-area streams fail this standard at times**

Planned Tasks

- **Correlate streamflow data with fecal counts**
- **Determine if monitoring data show same behavior for second part of water quality standard**
- **Discuss results with Island County management and Ecology**