IT'S NOT JUST THE WATER: BEACH SAND AS A POTENTIALLY OVERLOOKED SOURCE OF HUMAN, ENVIRONMENTAL, AND ANIMAL DISEASE

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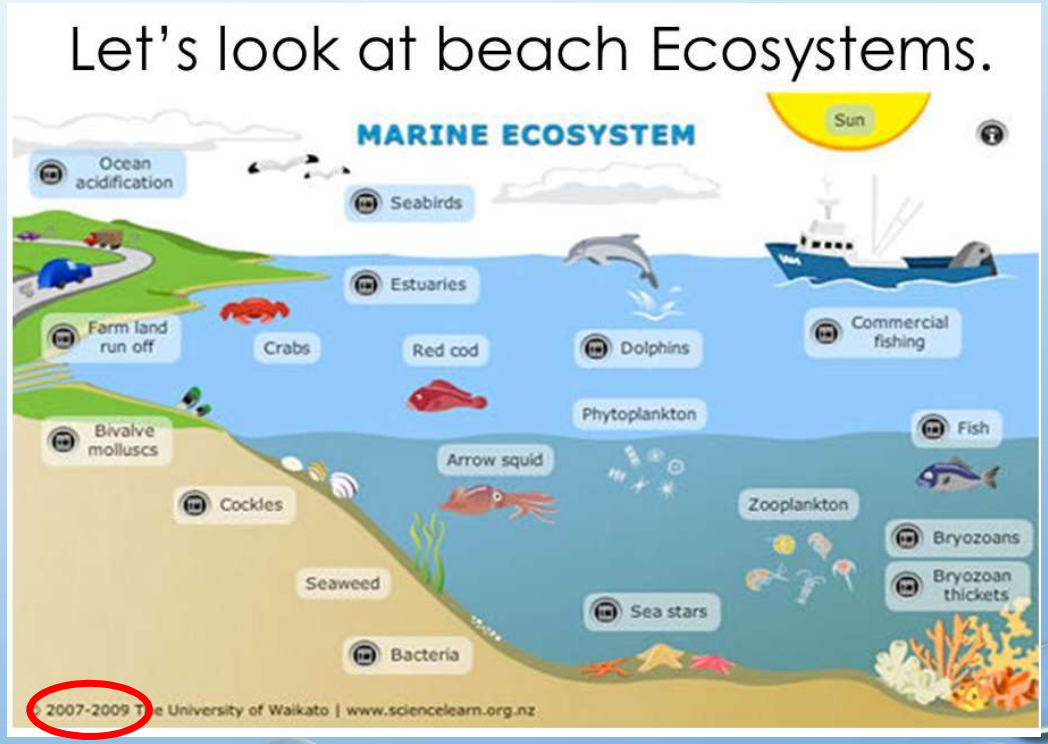
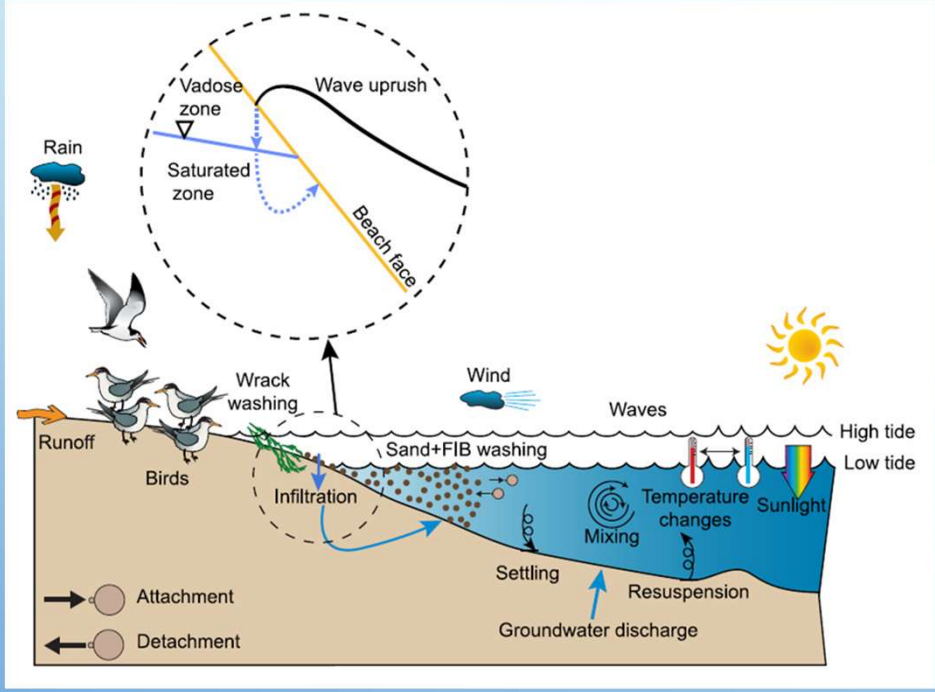
ESPP SYMPOSIUM - BALANCING ACT: FOOD, WATER, ENERGY, CLIMATE

TRADITIONAL BEACH HEALTH PERSPECTIVE



BEACH HEALTH THROUGH AN ECOSYSTEM LENS



STAY OUT OF THE SAND!!

Table 2. Illness Incidence According to Sand Exposure and Adjusted Incidence Proportion Ratios Comparing Those With Sand Exposure With Those Without Sand Exposure, NEEAR Study, 2003–2005, 2007[a]

	Incidence by Status of Digging in Sand						
	No		Yes		No.	aIPR	95% Confidence Interval
	No.	%	No.	%			
Gastrointestinal illness	1,009	7	873	8	25,807	1.13	1.02, 1.25
Diarrhea	676	4	592	6	25,989	1.20	1.05, 1.36
Respiratory illness	719	5	660	7	25,121	1.05	0.93, 1.19
Rash	404	3	325	3	25,977	1.02	0.86, 1.22
Eye ailments	511	3	267	3	26,473	0.85	0.72, 1.02
Earache	210	1	182	2	26,267	1.06	0.84, 1.33
Infected cuts	74	<1	42	<1	26,598	0.71	0.46, 1.08
	Incidence by Status of Body Buried in Sand						
	No		Yes		No.	aIPR	95% Confidence Interval
	No.	%	No.	%			
Gastrointestinal illness	1,654	7	228	9	25,800	1.23	1.05, 1.43
Diarrhea	1,120	5	148	6	25,982	1.24	1.01, 1.52
Respiratory illness	1,248	5	141	6	25,114	0.85	0.70, 1.04
Rash	650	3	79	3	25,970	1.01	0.80, 1.30
Eye ailments	716	3	62	3	26,466	0.98	0.73, 1.31
Earache	362	2	30	1	26,260	0.66	0.45, 0.99
Infected cuts	103	<1	13	<1	26,591	1.15	0.62, 2.13

Abbreviations: aIPR, adjusted incidence proportion ratio; NEEAR, National Epidemiological and Environmental Assessment of Recreational Water.

From Heaney et al. (2009)

Image source: Shutterstock

WHY IS SAND SO GROSS?

- SHORT ANSWER: BIOFILMS
- LONG ANSWER: LOTS OF COMPLEX AND INTERACTING PROCESSES THAT BRING PATHOGENS TO THE BEACH, ALLOW THEM TO ACCUMULATE, AND RELEASE THEM IN HIGH DENSITIES DURING DISTURBANCES!

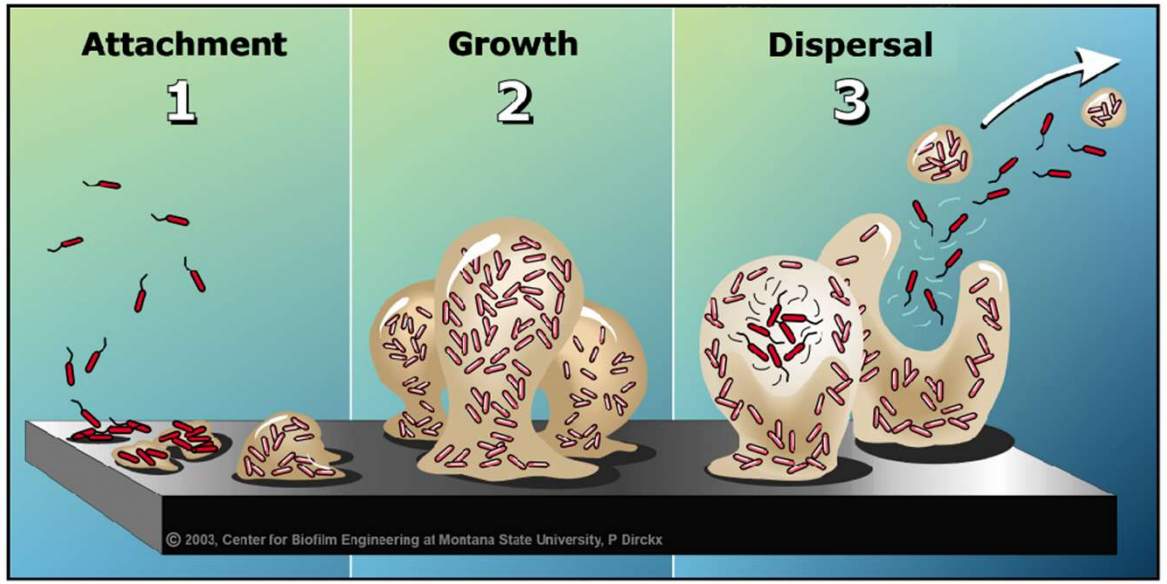


Image source: *Center for Biofilm Engineering at Montana State University*

…AND WHY SHOULD WE BE SO CONCERNED?

Image source: imgur.com

- 15 MILLION PEOPLE VISITED SOUTHERN CALIFORNIA BEACHES IN 2000-2001 (WOLCH AND ZHANG 2004)
- 122,321 PEOPLE VISITED LAKE ERIE BEACHES PER DAY IN 1998 (MURRAY AND SOHNGEN 2001)

ONE HEALTH: AN ADDITIONAL CONSIDERATION

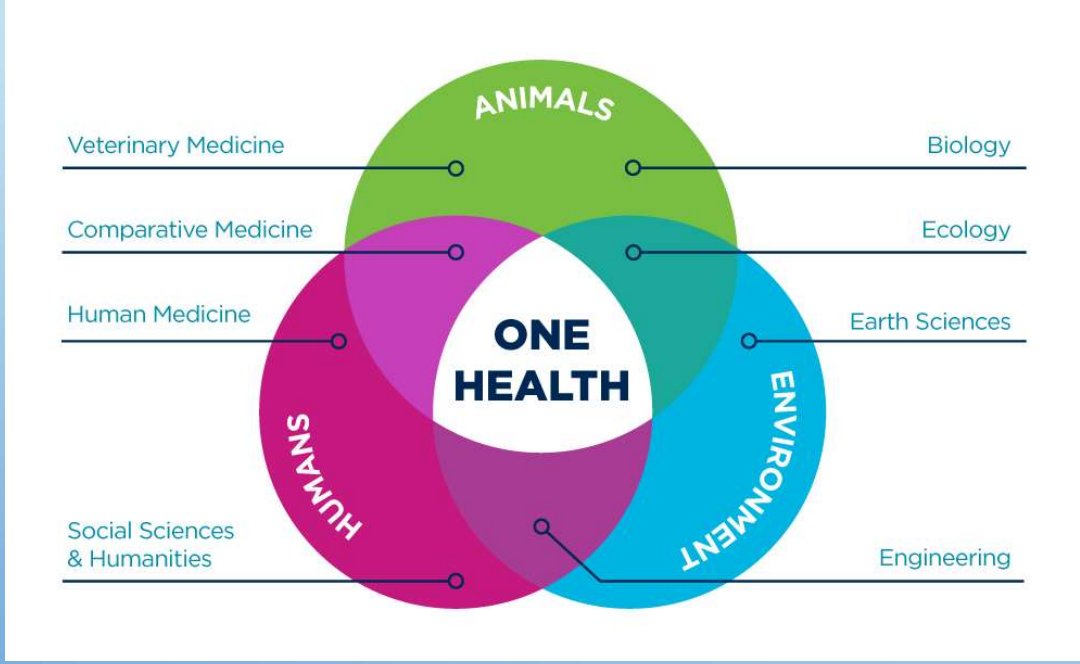
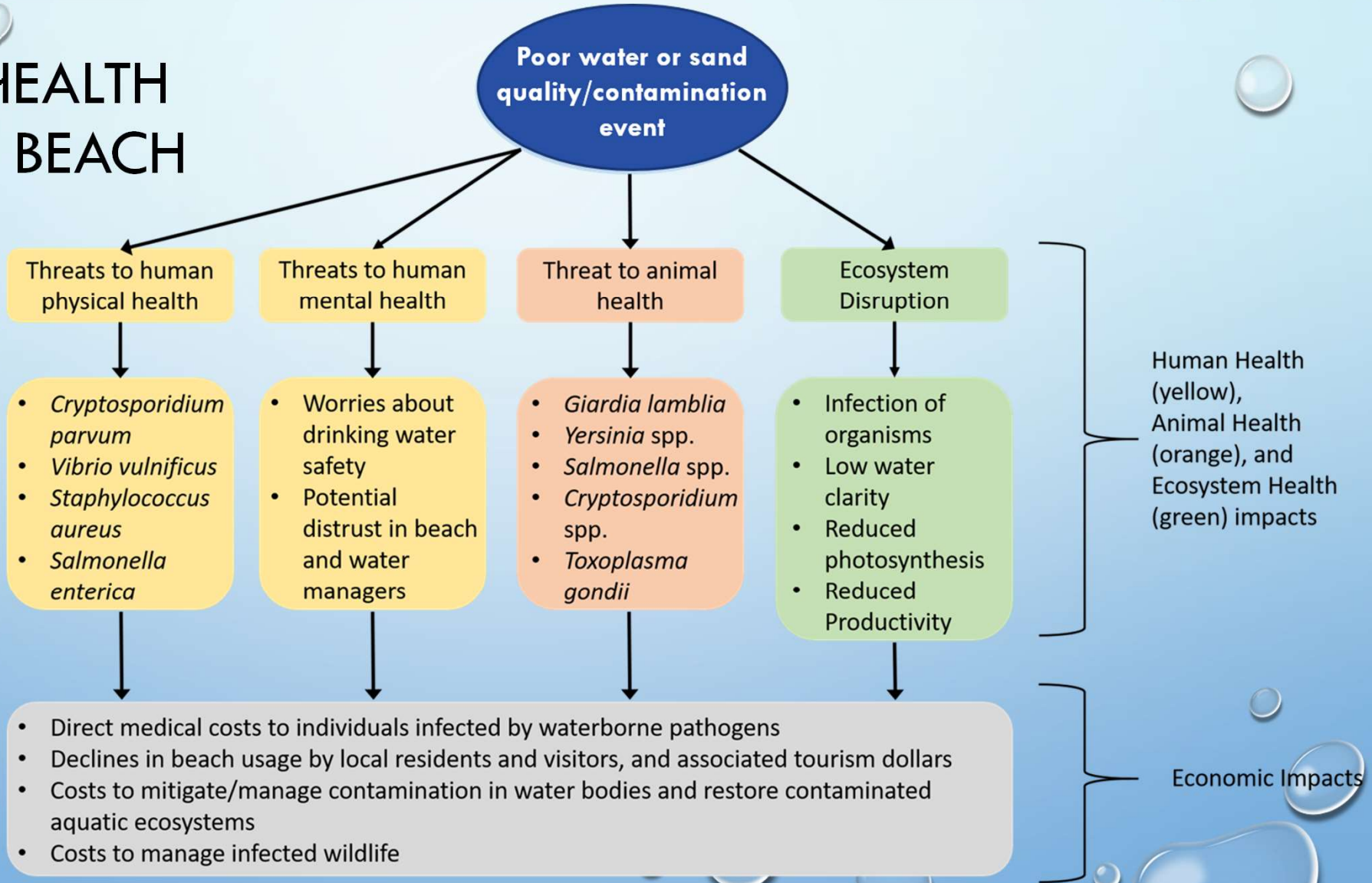


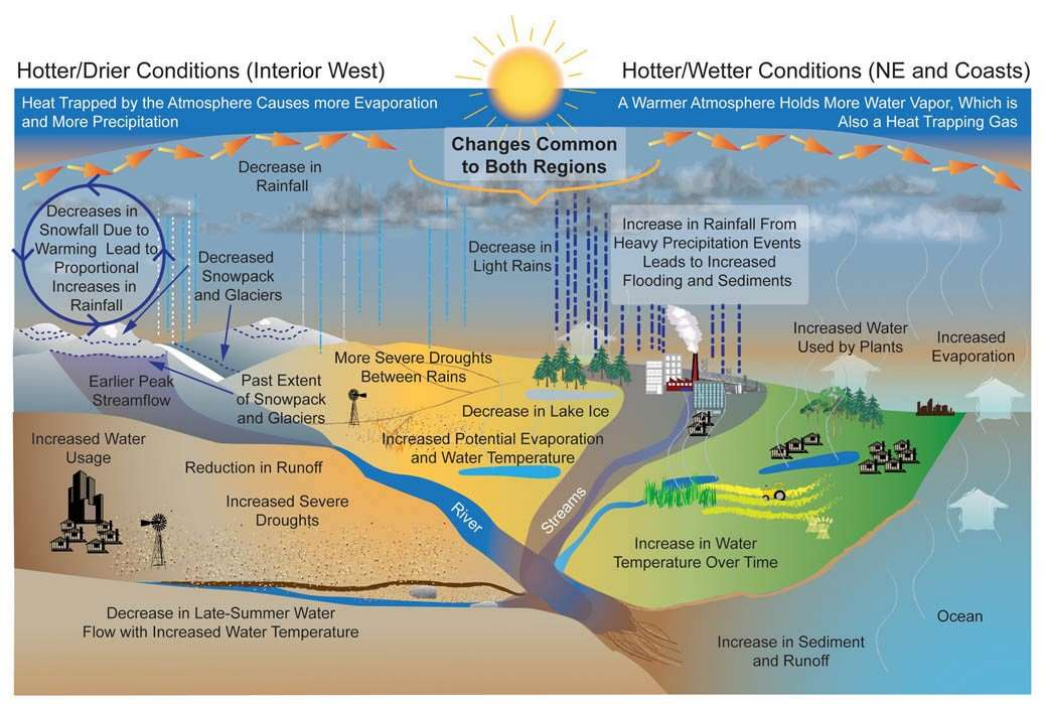
Image Source: UC Davis

- FUNDAMENTALLY AFFECTED BY THE CLIMATE-ENERGY-FOOD-WATER NEXUS
  - INDUSTRIAL AND AGRICULTURAL DEVELOPMENT
  - CLIMATE CHANGE EFFECTS ON MICROBES
  - WATER AS A SOURCE OF MICROBES TO SAND

ONE HEALTH AT THE BEACH



THE CLIMATE-ENERGY-FOOD-WATER NEXUS AT THE BEACH



1. AGRICULTURAL DEVELOPMENT AND FOOD PRODUCTION
2. INDUSTRIAL/ENERGY DEVELOPMENT
   - POPULATION GROWTH/IMMIGRATION
3. CLIMATE EFFECTS
   - INCREASING TEMPERATURES
   - INCREASING STORM INTENSITY

THE SAND-PEOPLE CONNECTION

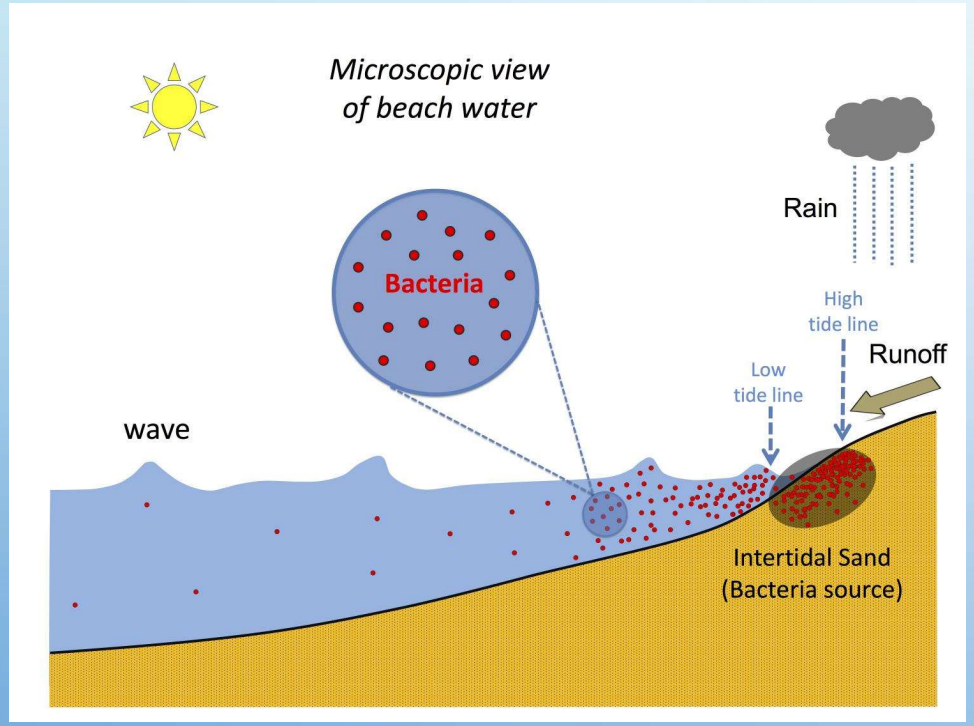
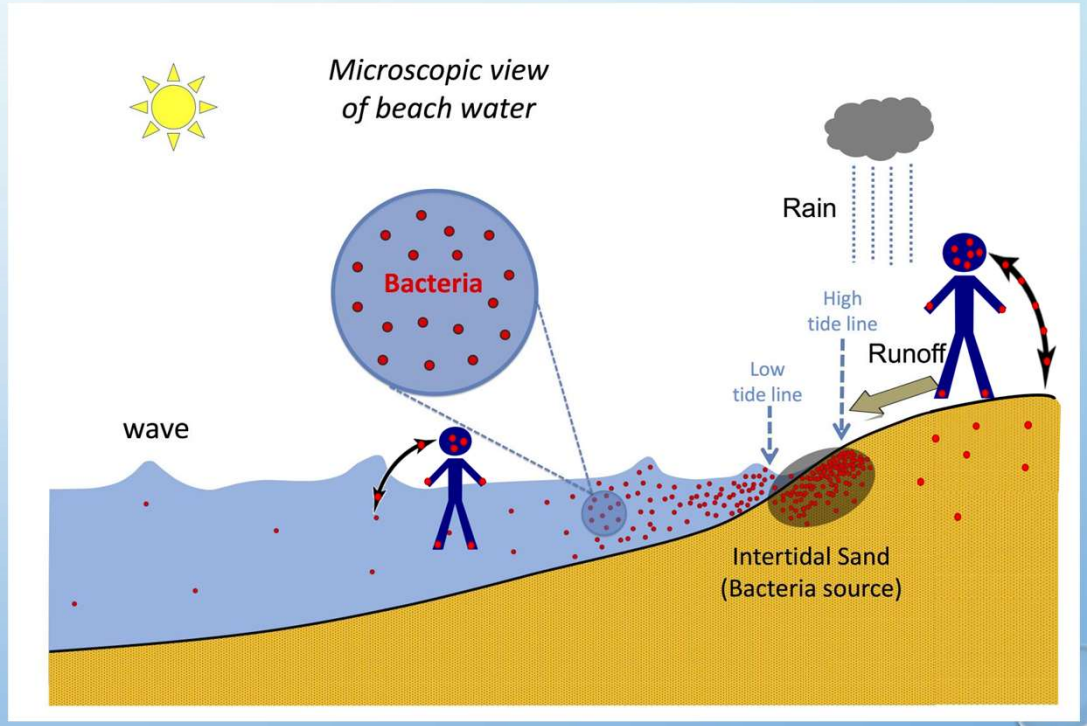


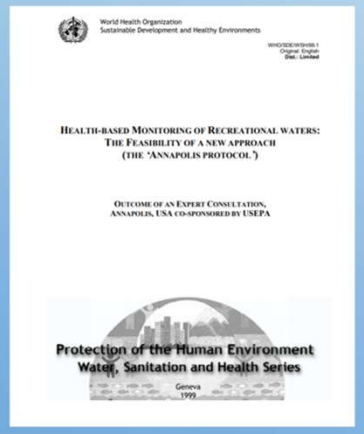
Image Source: Feng et al. (2015)

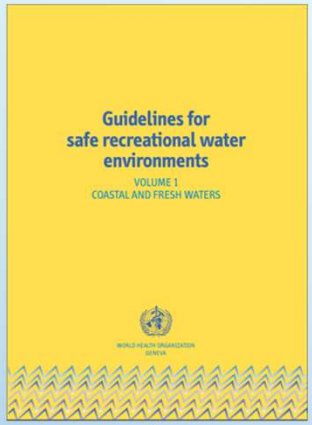
…A SMALL ADDITION:



THE SAND SCIENCE-POLICY DISCONNECTION

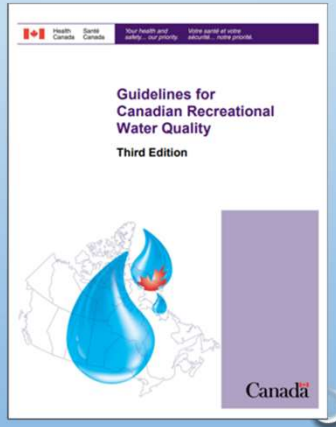
1999 – the Annapolis Protocol (WHO and USEPA 1999) is released, detailing recreational water monitoring guidelines





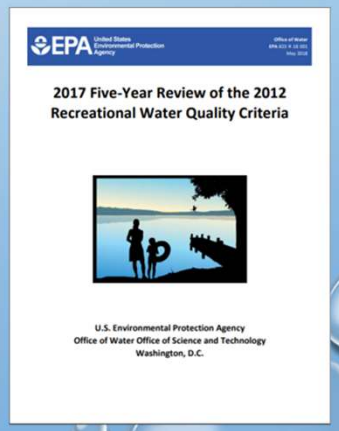
2003 – World Health Organization (WHO) recognizes beach sand as a possible factor in disease transmission

2012 – Canada acknowledges sand as a source of beach contamination



2017 – Argentina adopts sand management protocols for beach health monitoring

2018 – USA formally recognizes sand as a contamination source at beaches



RECOGNITION IS GOOD…

…ACTION IS BETTER

MOVING FORWARD

- MANAGEMENT OF SAND AS A SOURCE OF DISEASE TO BEACHGOERS OF ALL KINDS
- CONNECTIONS BETWEEN HEALTH, ENVIRONMENT, AND THE CLIMATE-FOOD-ENERGY-WATER NEXUS MUST BE MADE
- WE SHOULD ACCOUNT FOR PREDICTED CLIMATIC CHANGES, AS MUCH AS POSSIBLE
- EVERYTHING IS CONNECTED
    - WE SHOULD MANAGE RESOURCES WITH THIS IN MIND

REFERENCES

- MURRAY, CHRIS, BRENT SOHNGEN, AND LINWOOD PENDLETON. "VALUING WATER QUALITY ADVISORIES AND BEACH AMENITIES IN THE GREAT LAKES." *WATER RESOURCES RESEARCH* 37.10 (2001): 2583-2590.
- WOLCH, JENNIFER, AND JIN ZHANG. "BEACH RECREATION, CULTURAL DIVERSITY AND ATTITUDES TOWARD NATURE." *JOURNAL OF LEISURE RESEARCH* 36.3 (2004): 414-443.

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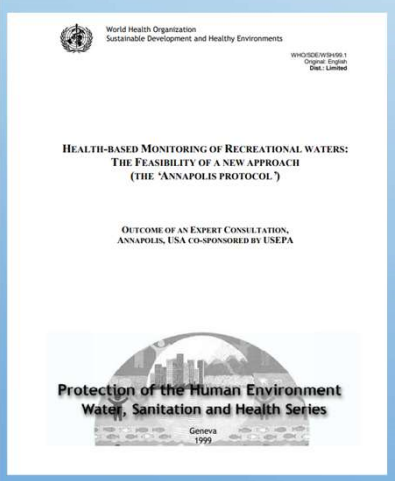

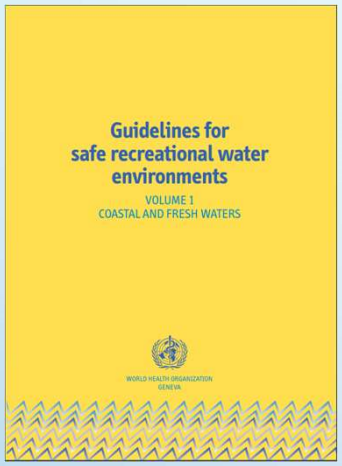

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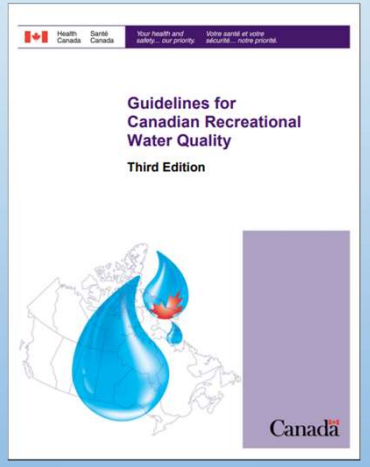

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