

# Two academics walk into a firm...

Green chemistry training across sectors

2018.04.30

# Where does the systems approach lead?

In spite of what you majored in, or what the textbooks say, or what you think you're an expert at, follow a system wherever it leads.

Seeing systems whole requires more than being “interdisciplinary.”

Dana Meadows

# Green chemistry in systems

- **Academics:** research, analysis, and training
- **Industry:** research, design and development
- **Government:** law and policy
- **NGOs:** advocacy and research

# Non-profits

# Systems interventions

- Provide science & policy research and expertise
- Develop methods, tools, standards, ecolabels
- Mobilize consumers
- Partner with business and regulators

# Challenges

- Funding is often inadequate and comes with extra demands
- Making people “get” green chemistry issues is critical
- Personal motivational investment in tackling difficult problems can be demoralizing

# Companies



# Barriers to green chemistry in industry

- **Economic and financial:** costs, incentives, markets
- **Regulatory:** uncertainty, disincentives
- **Technical:** expertise and training in science & engineering
- **Organizational:** how decision-making processes are structured
- **Definition and metrics:** unclear, complicated
- **Cultural:** values, awareness and education

Green chemistry is chemistry compliant with environmental laws

Green chemistry increases efficiency and helps to stay ahead of the curve on regulatory compliance

Green chemistry is part of a sustainable brand that attracts customers as well as top talent

Green chemistry is part of companies' ethical responsibility to protect workers, customers, and the environment

Green chemistry is chemistry



## Example: Apple

- Chemical hazard assessment and toxicology
- Materials science and analytical testing
- Full material disclosure
- Life cycle assessment

[apple.com/environment](https://apple.com/environment)

# Green chemistry system interventions

- Supporting academic research
- Cross-sector collaboration on methods, tools, standards
- Coordination on shared problems, e.g., influencing supply networks

# Environmental leadership needs

- Imaginative solutions
- Diversity of thought and representation
- Internal leadership – “champions”
- Capacity for ethical analysis

# Graduate training in green chemistry

# Green chemistry training needs

- Practice being in a position different from your own
- Encourage a diversity of skills & approaches
- Demonstrate and convey the value of interdisciplinary training

# The reflection scale

Instrumental / Empirical

Highly Reflective / Theoretical



**“Just do it”**  
Purely instrumental  
borrowing of methods,  
theories, concepts, models

**“Reflective doer”**

**“Navel gazer”**  
Deep analysis of the  
implications, the meaning,  
and potential outcomes



# “Hack your PhD”

- Look for opportunities to “stay a learner”
- Expand your own toolbox
- Develop ideas you believe in

# my part of the talk

L. Drew Hill, PhD MPH

April 30, 2018 | SAGE Sunset Celebration | Berkeley, CA

# industry and its footprint

can operate on very large scales

often major environmental, health footprints

- emissions and waste
- resource processing procedures
- long supply chains



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Polyester Production is Carbon Intensive

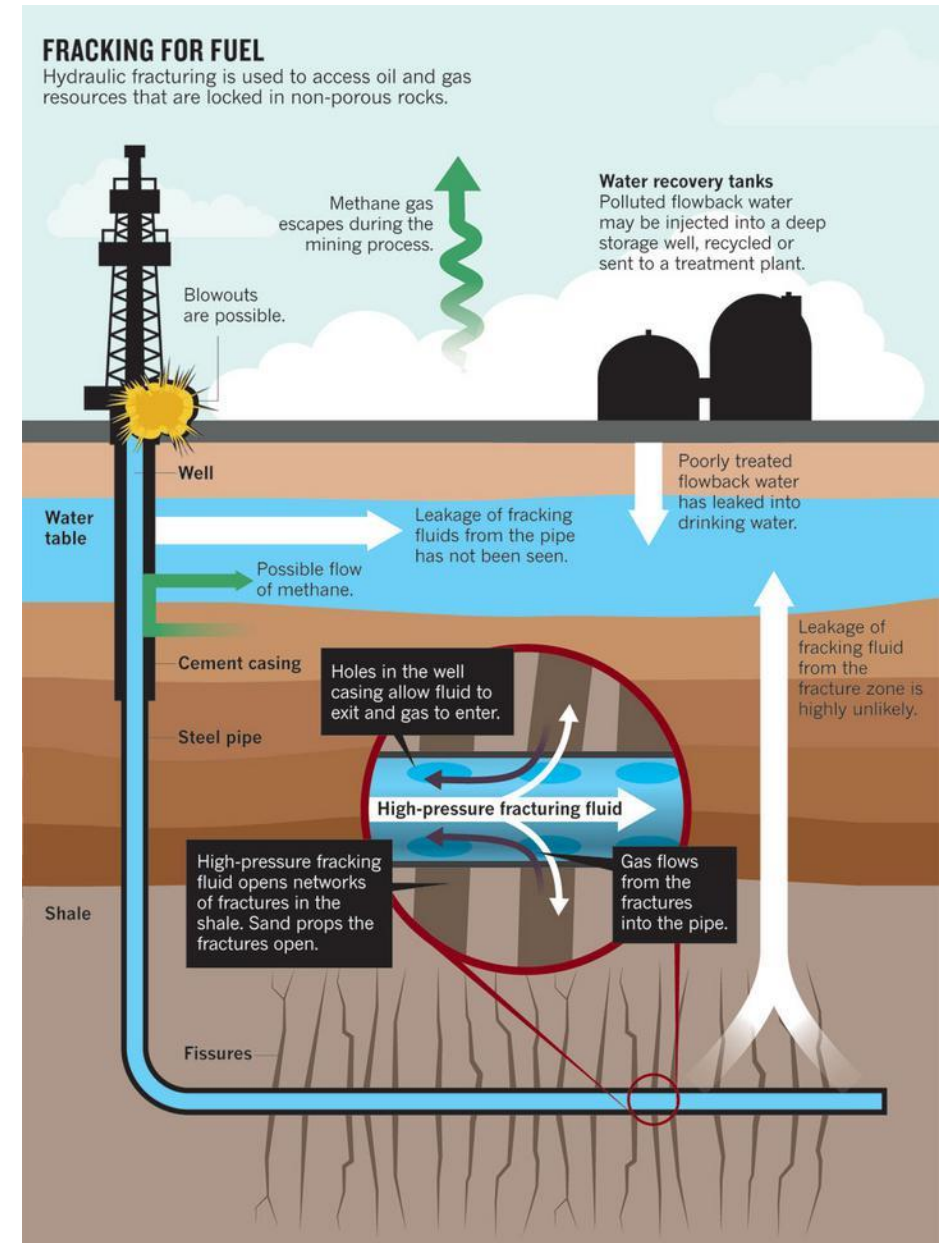


Source: MIT

# industry and its footprint

## oil and gas wells

- potential environmental and health footprint
  - Air pollution
  - Water and soil contamination
  - Noise, stress

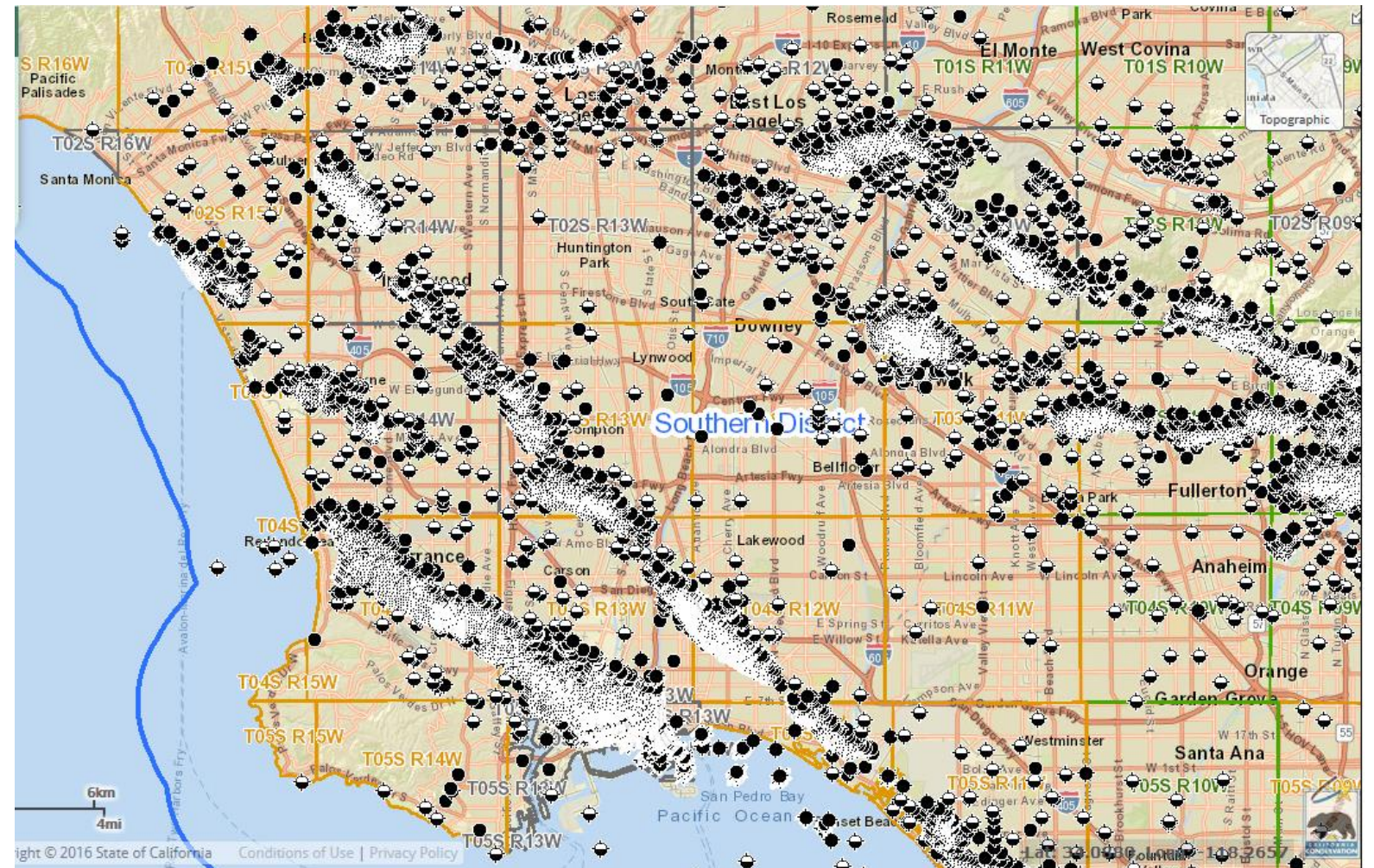


# industry and its footprint

## DOGGR Wells, Los Angeles

### energy production

- California  
5.4 million people live within 1 mile of oil and gas wells (NRDC 2014)
- Los Angeles County:  
580,000 live within a quarter mile of oil and gas wells (NRDC 2014)



# leveraging systems-minded academics

this impact is shaped by real people making decisions, large and small

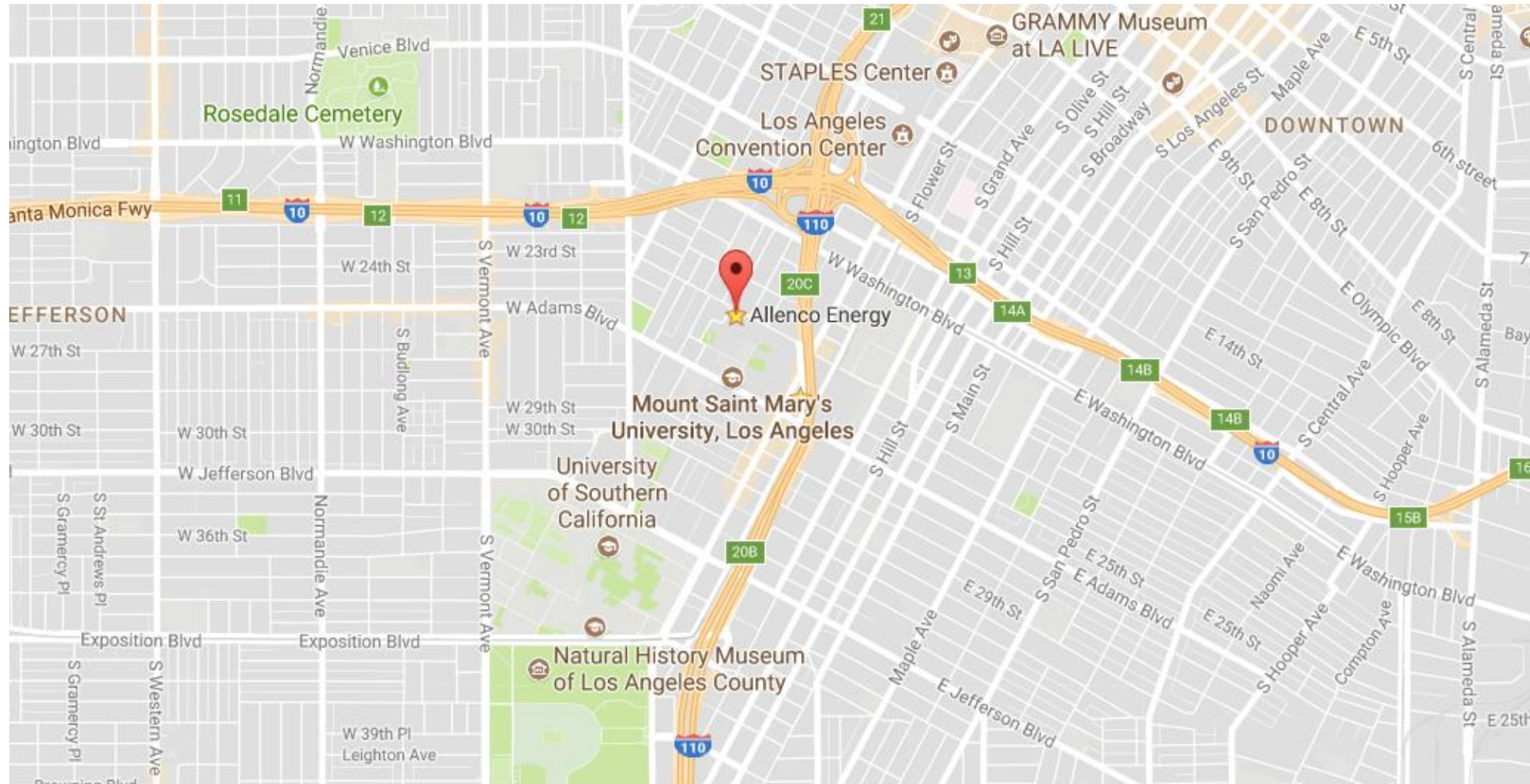
- Can be myopic and performed in silos
  - e.g. business dev, engineering, environmental management
- often driven by quarterly-earnings, despite potential for long-term gains

“An Interdisciplinary Approach to Sustainability” and “Greener Solutions”

- greener, healthier alternatives exist to many processes, products, chemicals
- those decisions can be made with green chemistry, public health in mind!
- proactive is best; retroactive is still useful!

academics can and should be involved to improve the environment & health outcomes of industry decisions

# AllenCo—University Park/Downtown LA





# AllenCo Neighborhood

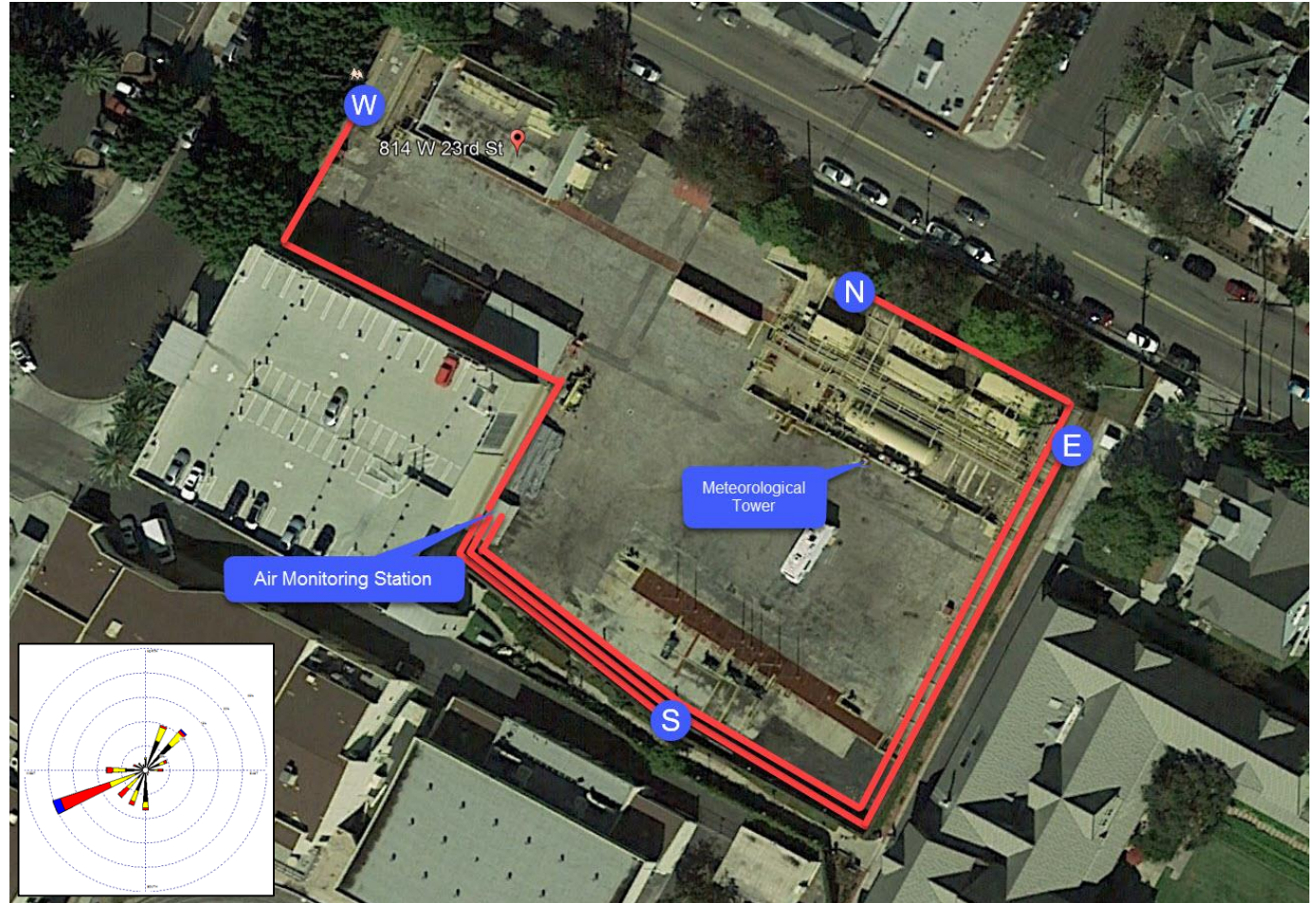


# AllenCo oil field

- local community became engaged after experiencing health maladies
- AllenCo was sued for cleaner operation
- Exponent hired to assess cleanup measures, keep community properly informed
- inform, empower, affect positive change
  - rigorously assess impact of oil field on local community
    - measurements before modifications, during a period of shutdown, and after modifications
  - set examples and procedures for future energy companies to:
    - engage the community
    - employ clean, sustainable processes as preventative measures

# Fence Line Sampling System

- Four inlets
- Continuous purge
- Teflon tubing
- Rotating sampling



# General Solution (?): Community Monitoring

Current Example—South Coast Area

- 38 monitoring stations
- 10,743 square miles
- 16.8 million people
- 283 square miles per station
- 442,000 people per station

## Questions:

- Is this adequate? What do you think?
- How can neighborhoods understand their risks from near-by industry?

## South Coast AQMD Monitoring Stations



Thanks!



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