# MATH MODELING CAN MAKE YOU FILTHY RICH


**ROBERT KAPLINSKY**

robert@robertkaplinsky.com

robertkaplinsky.com

@robertkaplinsky

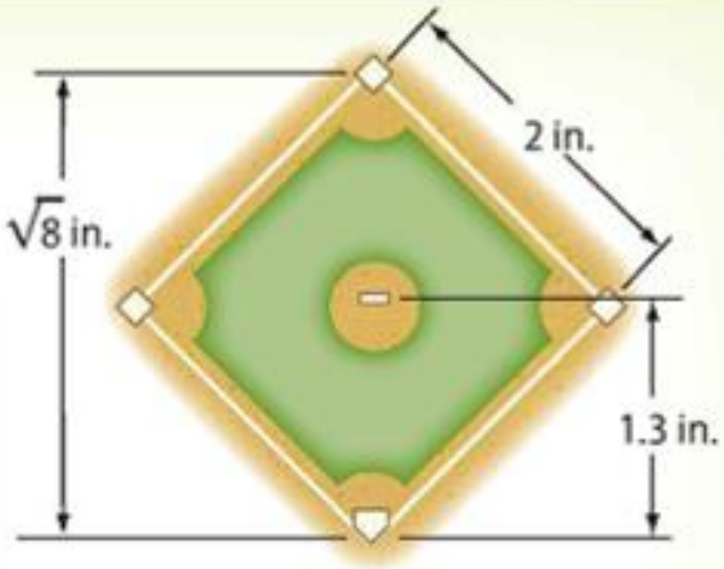
# Real-World Link

**Common Core State Standards**

**Content Standards**
8.NS.1, 8.NS.2, 8.EE.2

**Mathematical Practices**
1, 3, 4, 6

**Sports** Major League baseball has rules for the dimensions of the baseball diamond. A model of the diamond is shown.




**1.** On the model, the distance from the pitching mound to home plate is 1.3 inches. Is 1.3 a rational number? Explain.

**2.** On the model, the distance from first base to second base is 2 inches. Is 2 a rational number? Explain.

**3.** The distance from home plate to second base is $\sqrt{8}$ inches. Using a calculator, find $\sqrt{8}$. Does it appear to terminate or repeat?

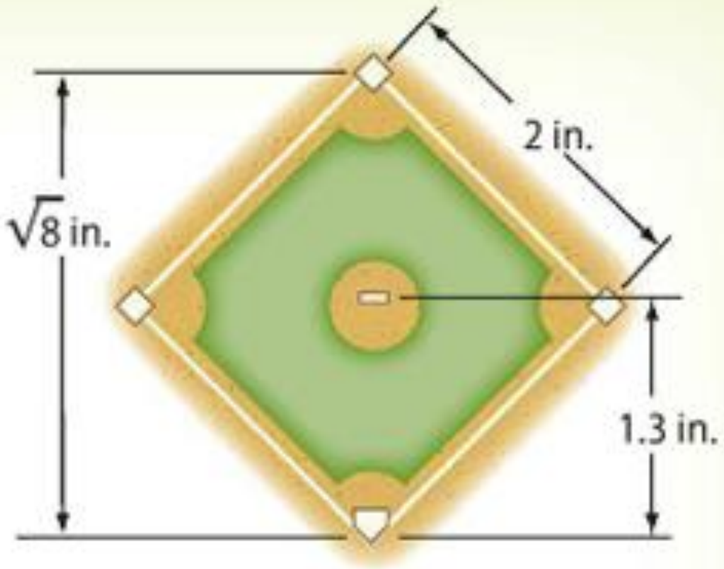
# Real-World Link

**Common Core State Standards**

**Content Standards**
8.NS.1, 8.NS.2, 8.EE.2

**Mathematical Practices**
1, 3, 4, 6

**Sports** Major League baseball has rules for the dimensions of the baseball diamond. A model of the diamond is shown.




1. On the model, the distance from the pitching mound to home plate is 1.3 inches. Is 1.3 a rational number? Explain.

2. On the model, the distance from first base to second base is 2 inches. Is 2 a rational number? Explain.

3. The distance from home plate to second base is $\sqrt{8}$ inches. Using a calculator, find $\sqrt{8}$. Does it appear to terminate or repeat?

# Doritos® & Cheetos® Mix

20 Singles

DORITOS® Nacho Cheese Flavored Tortilla Chips 1 OZ. EA. DORITOS® COOL RANCH® Flavored Tortilla Chips 1 OZ. EA. CHEETOS® Puffs Cheese Flavored Snacks 7/8 OZ. EA. CHEETOS® Crunchy Cheese Flavored Snacks 1 OZ. EA.

20 INDIVIDUAL BAGS: 7/8 OZ. EACH, 1 OZ. EACH, TOTAL NET WT. 19 5/8 OZ. (1 LB. 3 5/8 OZ.) 556.3 g

⚠ WARNING: PREVENT ENTANGLEMENT AND STRANGULATION. KEEP THIS BAG AWAY FROM YOUNG CHILDREN. IT IS NOT A TOY.

# THINKING TIME

- Why did many of you expect there to be five of each?
- Why was it not five of each?
- How might they decide on this combination?

# Classic Mix

**20 Singles**

LAY'S® Classic Potato Chips, DORITOS® Nacho Cheese Flavored Tortilla Chips, DORITOS® COOL RANCH® Flavored Tortilla Chips, CHEETOS® Crunchy Cheese Flavored Snacks, SUNCHIPS® Original Multigrain Snacks, FRITOS® Original Corn Chips (All 1 OZ. Each)

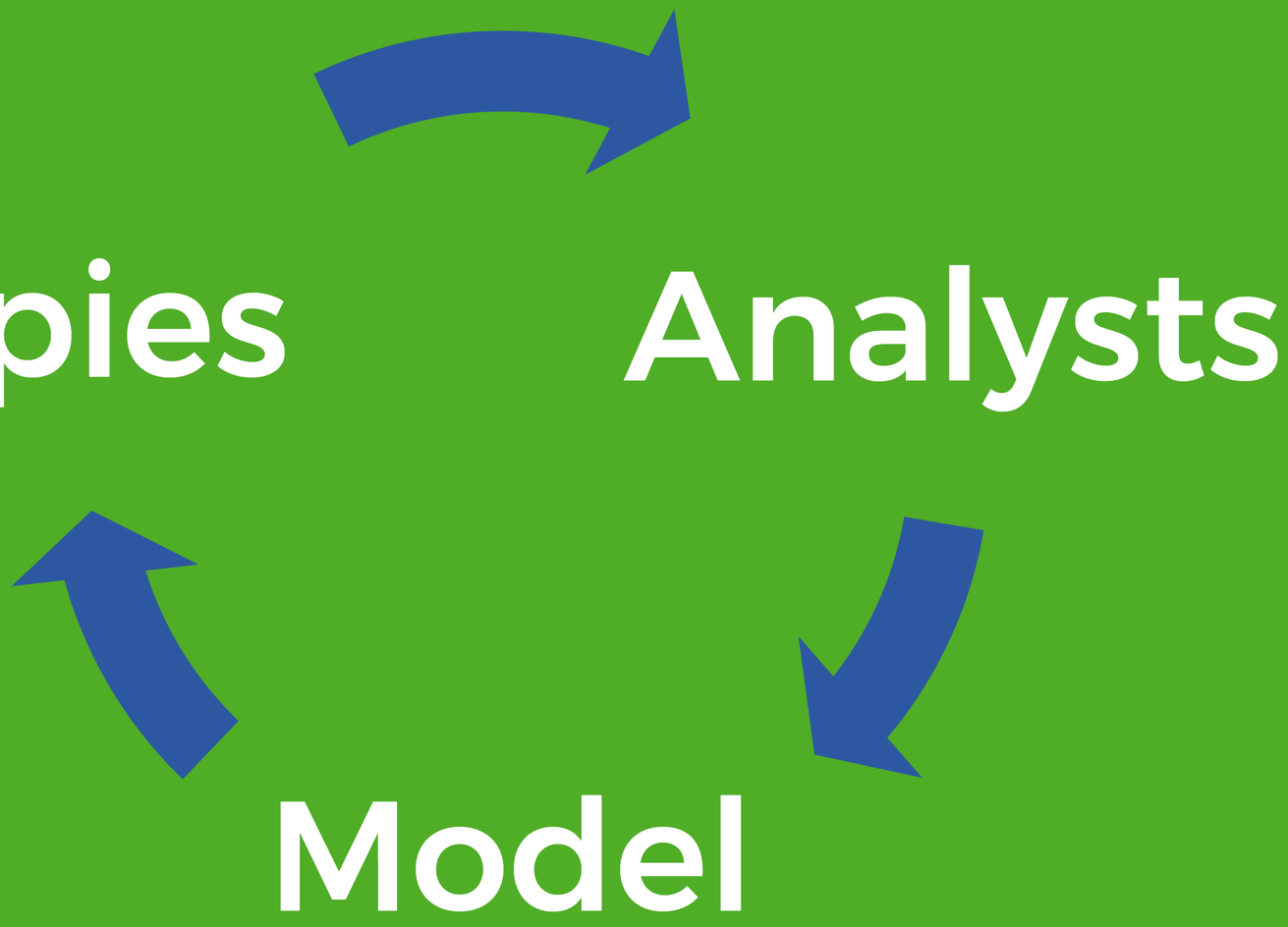
20 INDIVIDUAL BAGS: 1 OZ. EACH, TOTAL NET WT. 20 OZ. (1 LB. 4 OZ.) 567 g

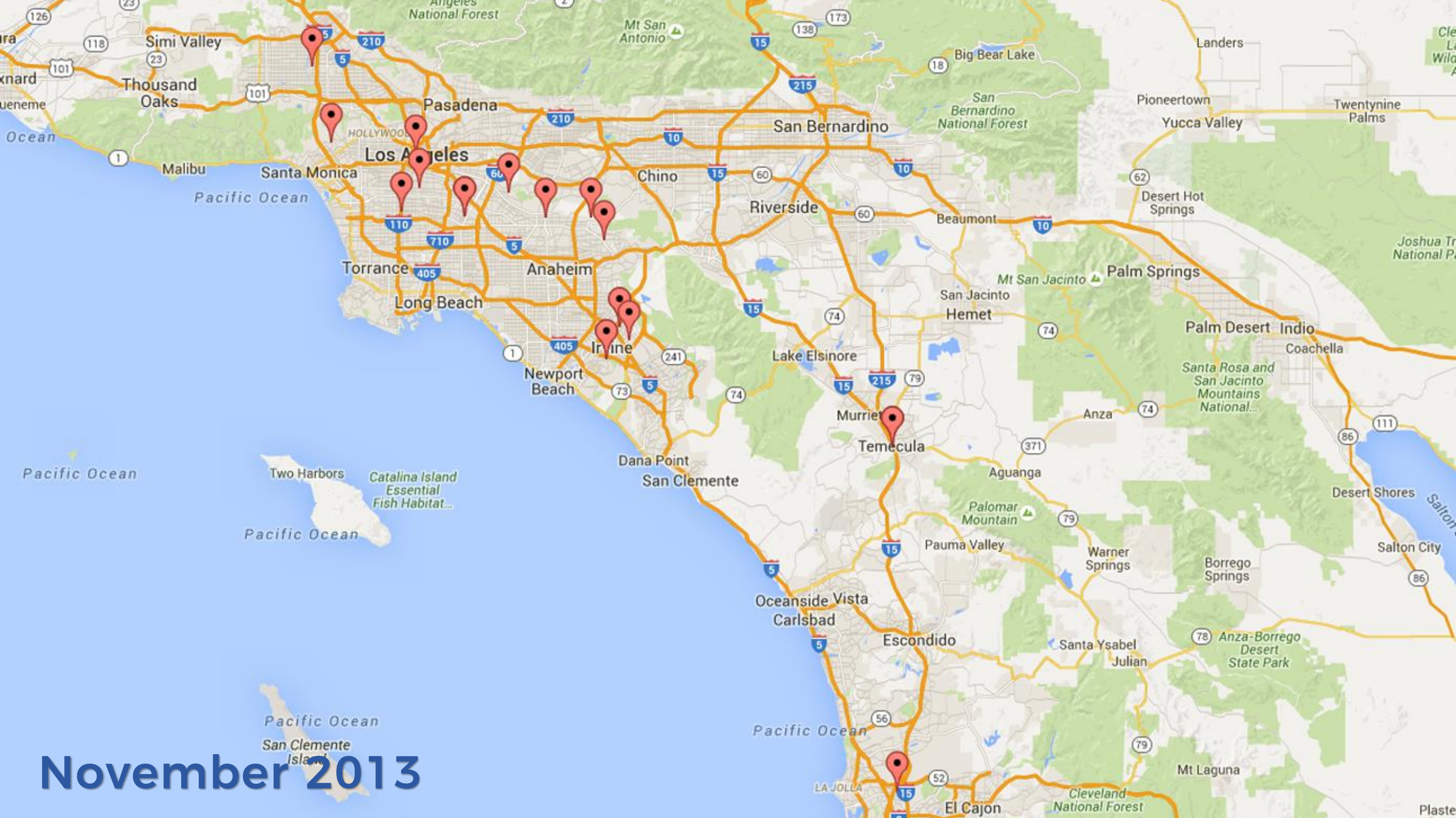
⚠ WARNING: PREVENT ENTANGLEMENT AND STRANGULATION. KEEP THIS BAG AWAY FROM YOUNG CHILDREN. IT IS NOT A TOY.

# GOALS

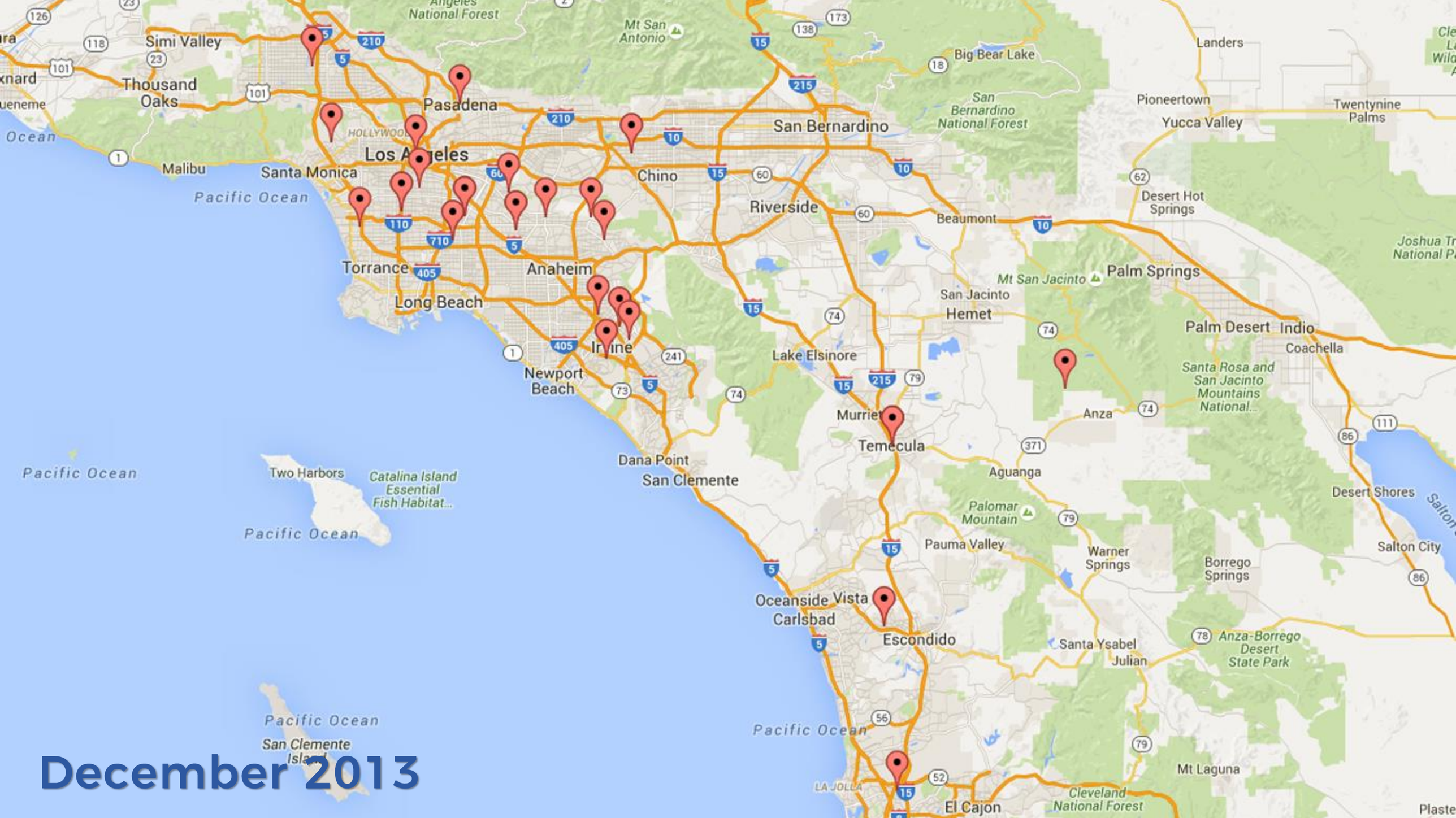
- ❑ HOW DO WE MAKE SENSE OF MATH MODELING?
- ❑ IS IT JUST ANSWERING QUESTIONS?
- ❑ HOW DO YOU PROFIT FROM  MATH MODELING?
- ❑ HOW DO WE HELP OUR STUDENTS IMPROVE?
- ❑ WHERE CAN WE FIND MORE RESOURCES?

CENTRAL INTELLIGENCE AGENCY
UNITED STATES OF AMERICA

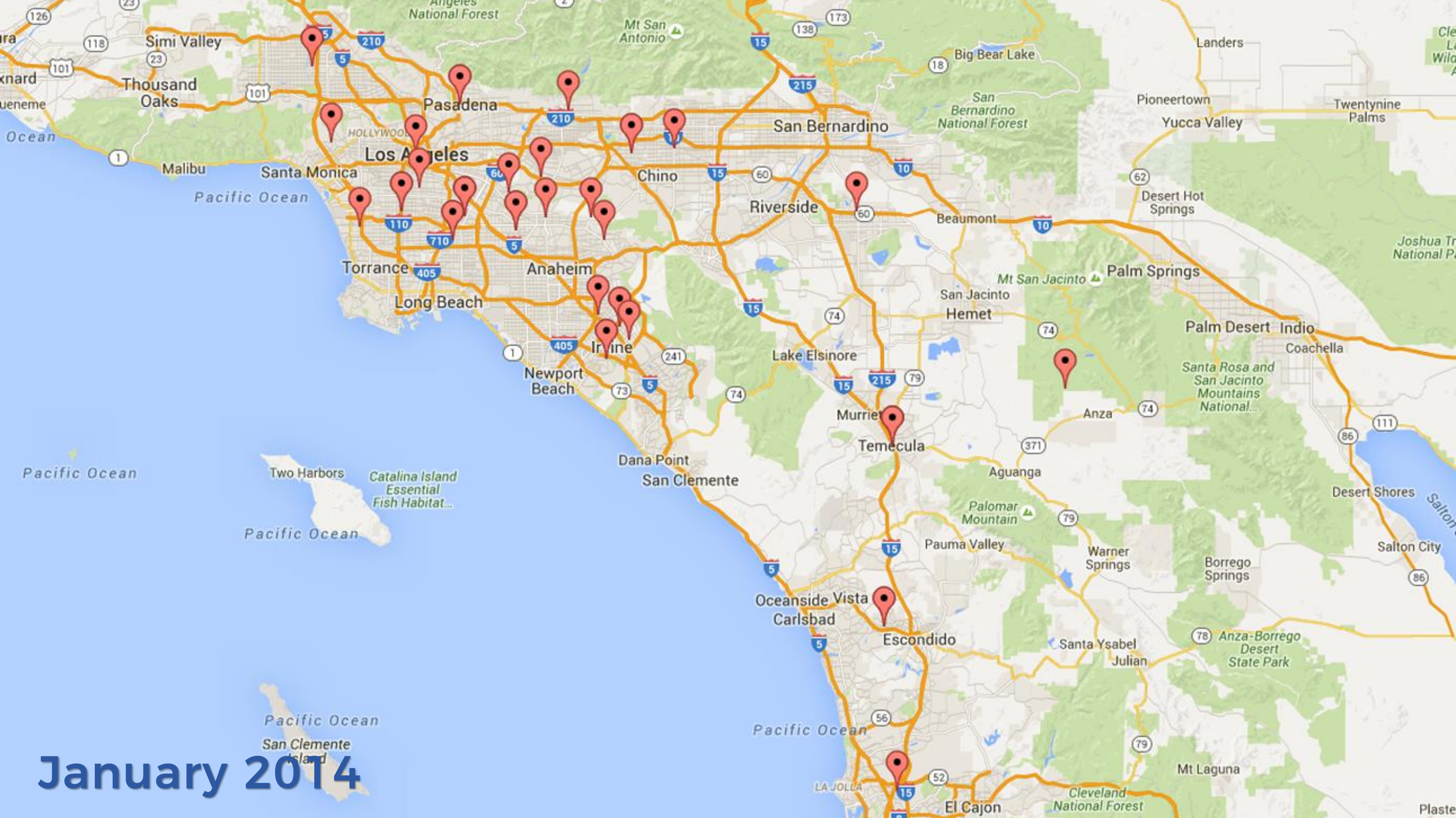

Spies
Analysts
Model



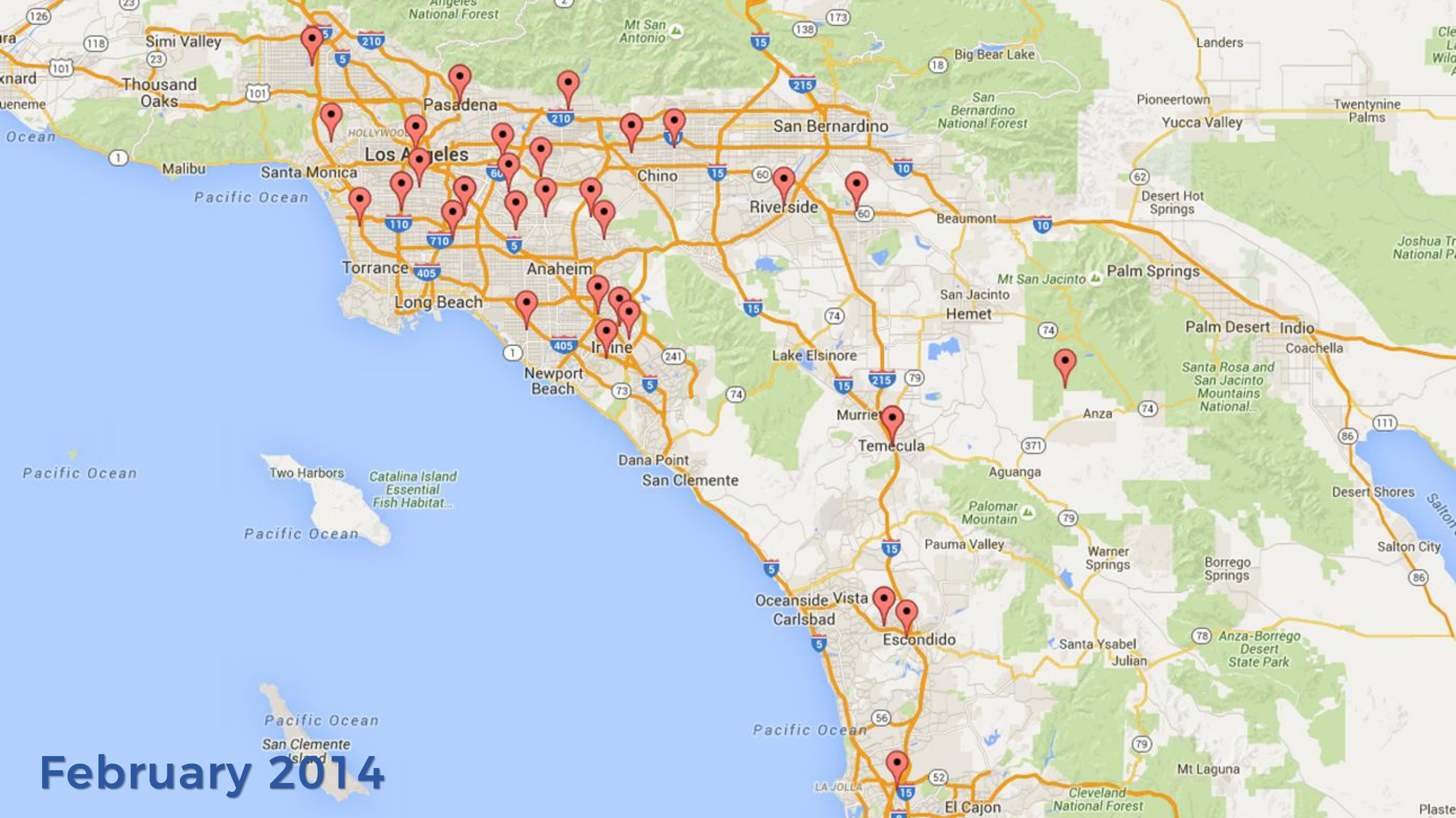

# November 2013



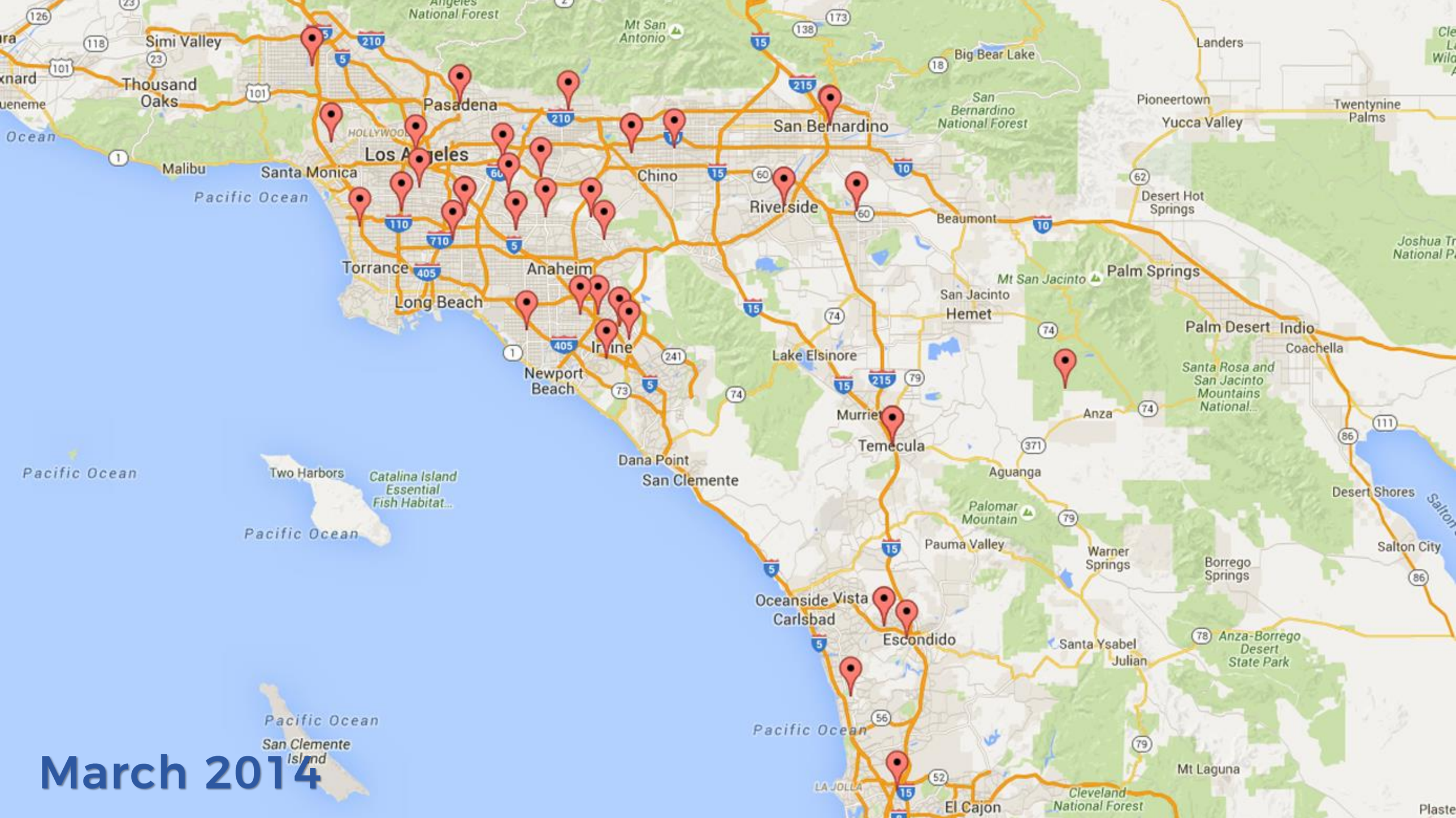

# December 2013



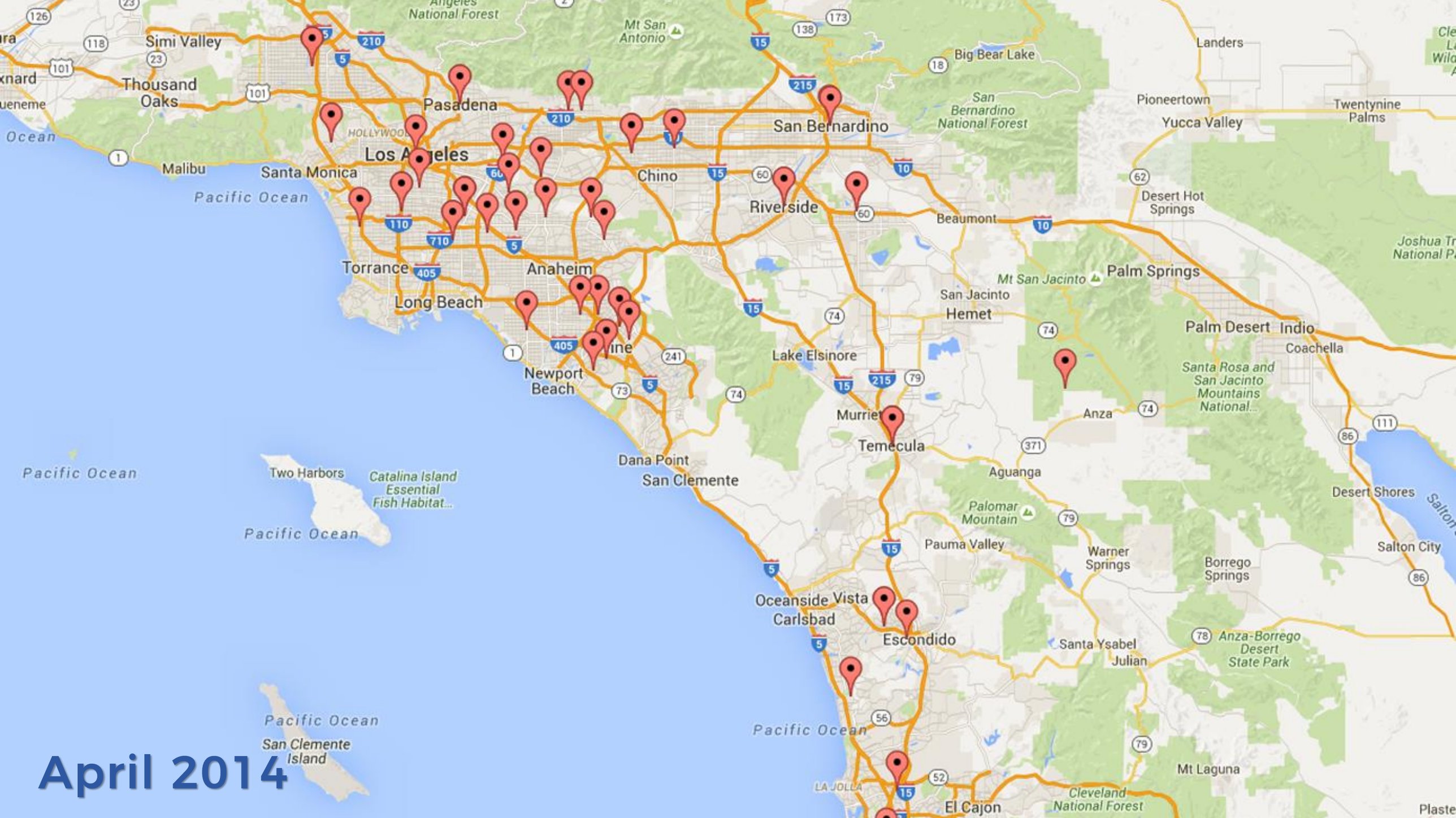

# January 2014



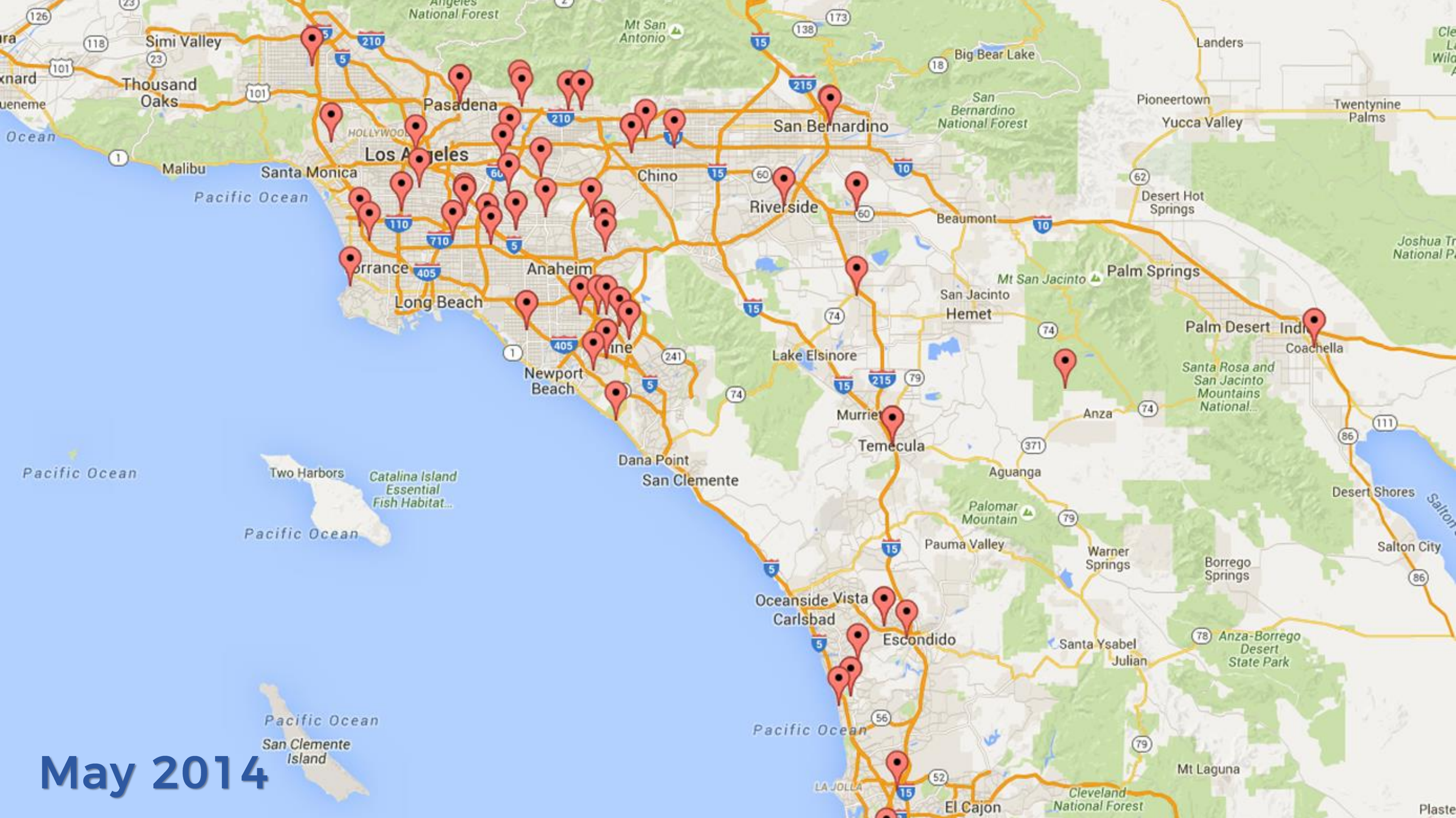

# February 2014


Simi Valley
Thousand Oaks
Pasadena
Los Angeles
Malibu
Santa Monica
Pacific Ocean
Chino
San Bernardino
Riverside
Big Bear Lake
Landers
Pioneertown
Yucca Valley
Twentynine Palms
Desert Hot Springs
Beaumont
Palm Springs
Mt San Jacinto
San Jacinto
Hemet
Palm Desert
Indio
Coachella
Torrance
Anaheim
Long Beach
Irvine
Newport Beach
Lake Elsinore
Murrieta
Temecula
Anza
Aguanga
Dana Point
San Clemente
Two Harbors
Catalina Island Essential Fish Habitat...
Oceanside
Vista
Carlsbad
Escondido
Pauma Valley
Warner Springs
Borrego Springs
Salton City
Desert Shores
Santa Ysabel
Julian
Anza-Borrego Desert State Park
Mt Laguna
El Cajon
Cleveland National Forest
LA JOLLA
San Clemente Island

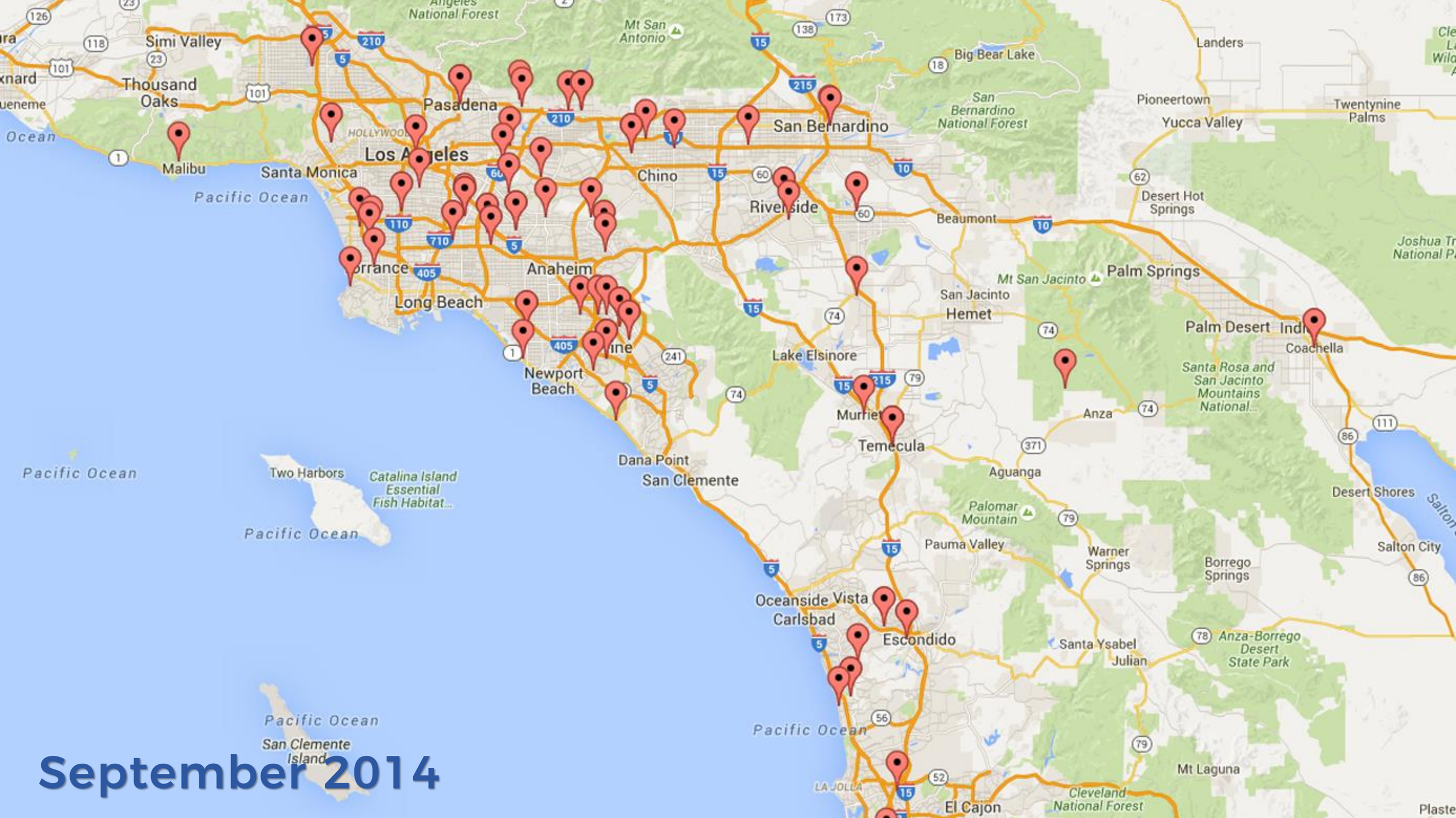
# March 2014


Simi Valley
Thousand Oaks
Pasadena
Los Angeles
Malibu
Santa Monica
Pacific Ocean
Torrance
Long Beach
Anaheim
Chino
San Bernardino
Riverside
Big Bear Lake
Landers
Pioneertown
Yucca Valley
Twentynine Palms
Desert Hot Springs
Beaumont
Palm Springs
Mt San Jacinto
San Jacinto
Hemet
Palm Desert
Indio
Coachella
Lake Elsinore
Murrieta
Temecula
Anza
Aguanga
Dana Point
San Clemente
Newport Beach
Two Harbors
Catalina Island Essential Fish Habitat...
Oceanside
Vista
Carlsbad
Escondido
Pauma Valley
Warner Springs
Borrego Springs
Salton City
Desert Shores
Santa Ysabel
Julian
Anza-Borrego Desert State Park
Palomar Mountain
Mt Laguna
El Cajon
Cleveland National Forest
San Clemente Island
LA JOLLA

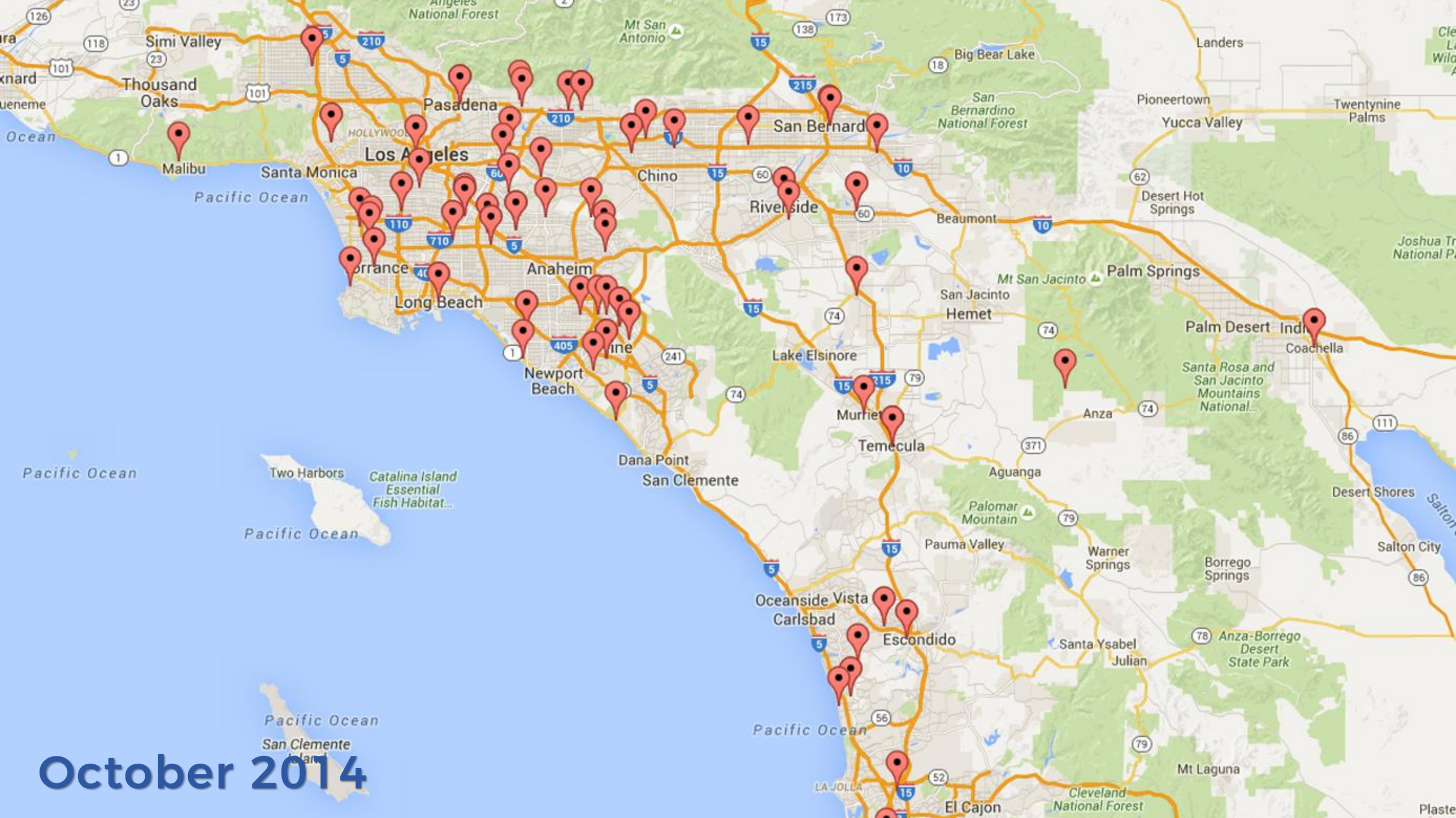
# April 2014


Simi Valley
Thousand Oaks
Pasadena
Los Angeles
Santa Monica
Malibu
Pacific Ocean
Chino
San Bernardino
Riverside
Big Bear Lake
San Bernardino National Forest
Landers
Pioneertown
Yucca Valley
Twentynine Palms
Desert Hot Springs
Beaumont
Palm Springs
Mt San Jacinto
San Jacinto
Hemet
Palm Desert
Coachella
Anaheim
Long Beach
Newport Beach
Lake Elsinore
Murrieta
Temecula
Anza
Santa Rosa and San Jacinto Mountains National...
Dana Point
San Clemente
Aguanga
Two Harbors
Catalina Island Essential Fish Habitat...
Palomar Mountain
Pauma Valley
Warner Springs
Borrego Springs
Desert Shores
Salton City
Oceanside
Vista
Carlsbad
Escondido
Santa Ysabel
Julian
Anza-Borrego Desert State Park
San Clemente Island
Mt Laguna
El Cajon
Cleveland National Forest
LA JOLLA

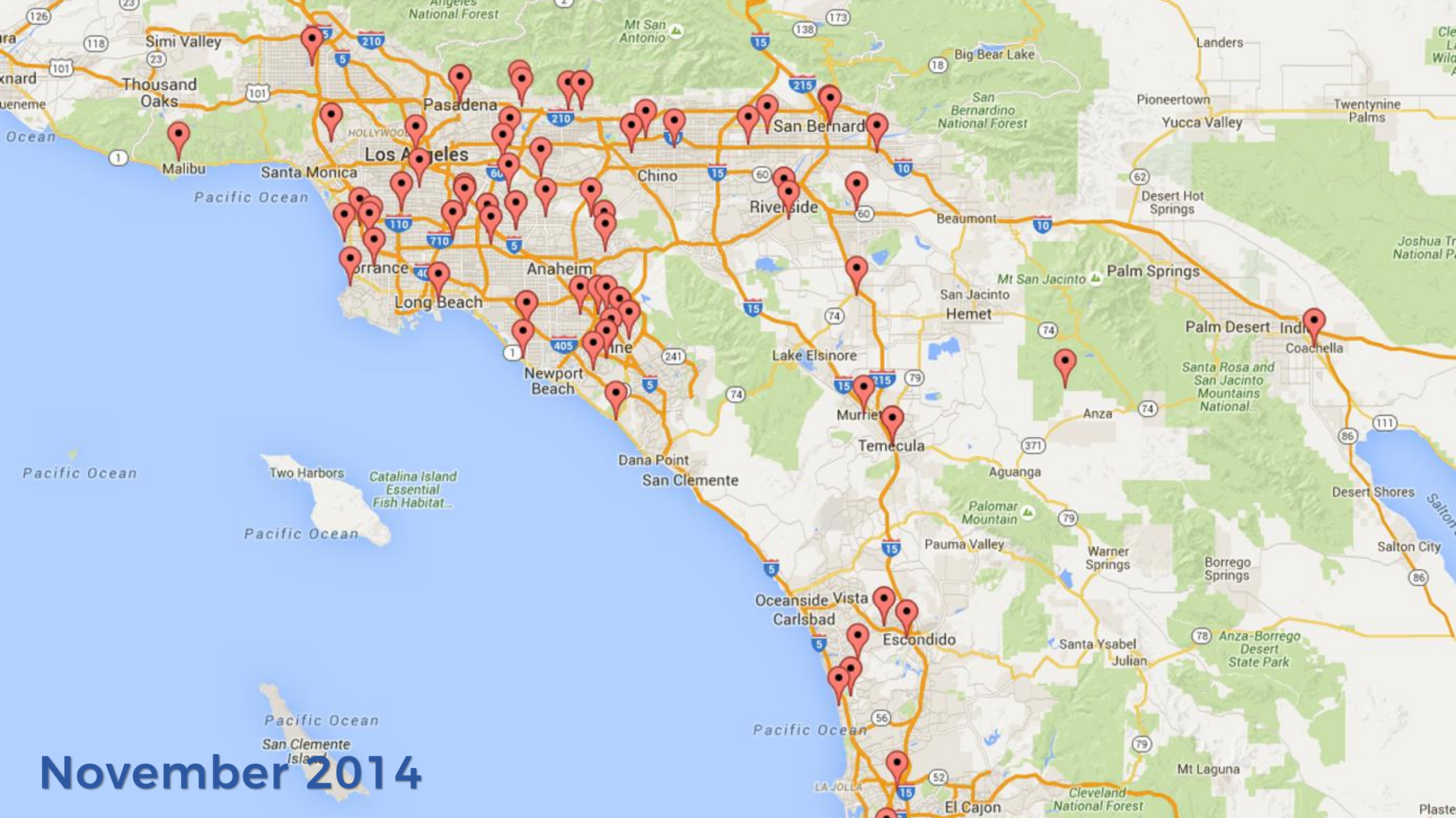
# May 2014



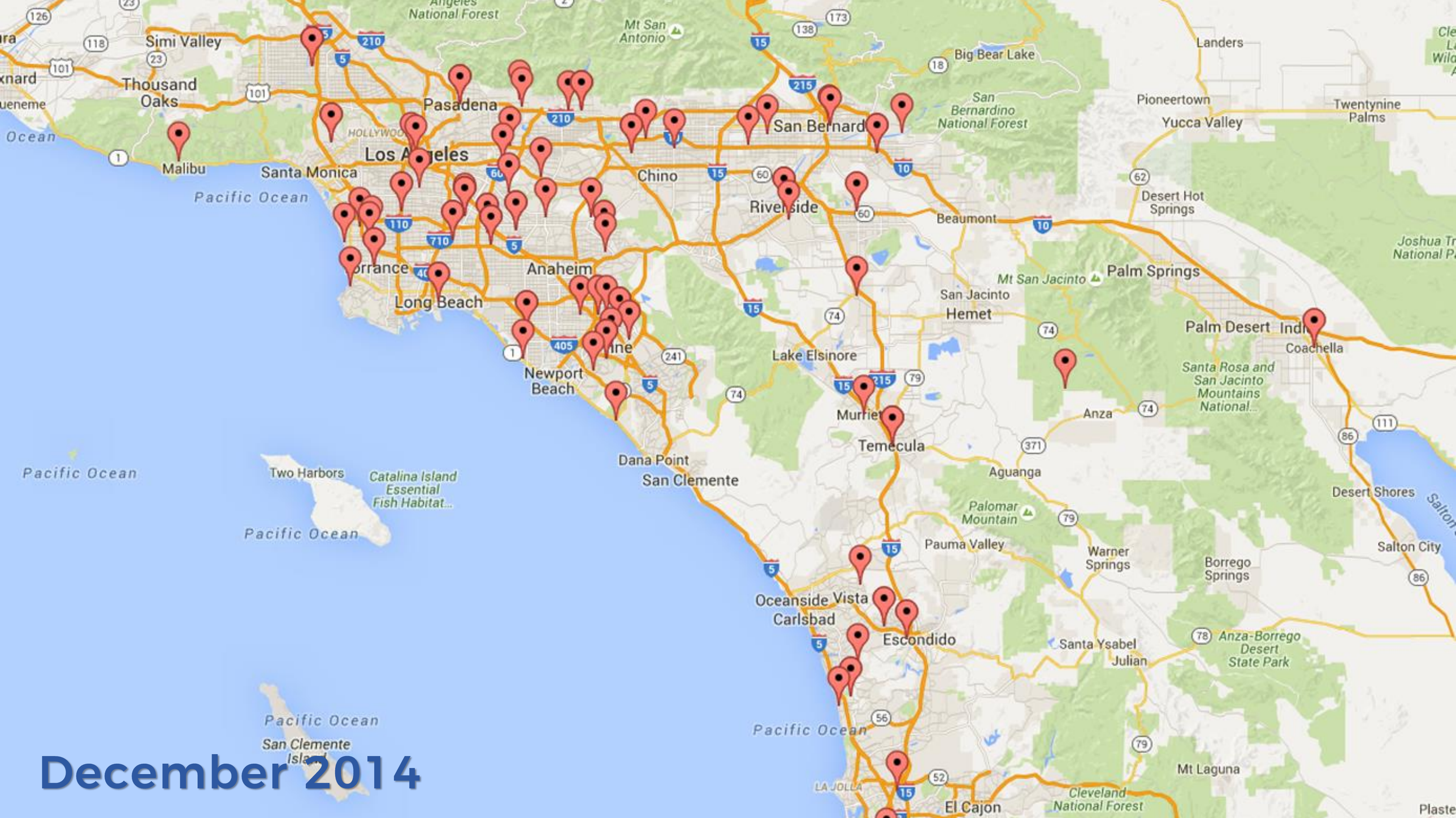

# September 2014



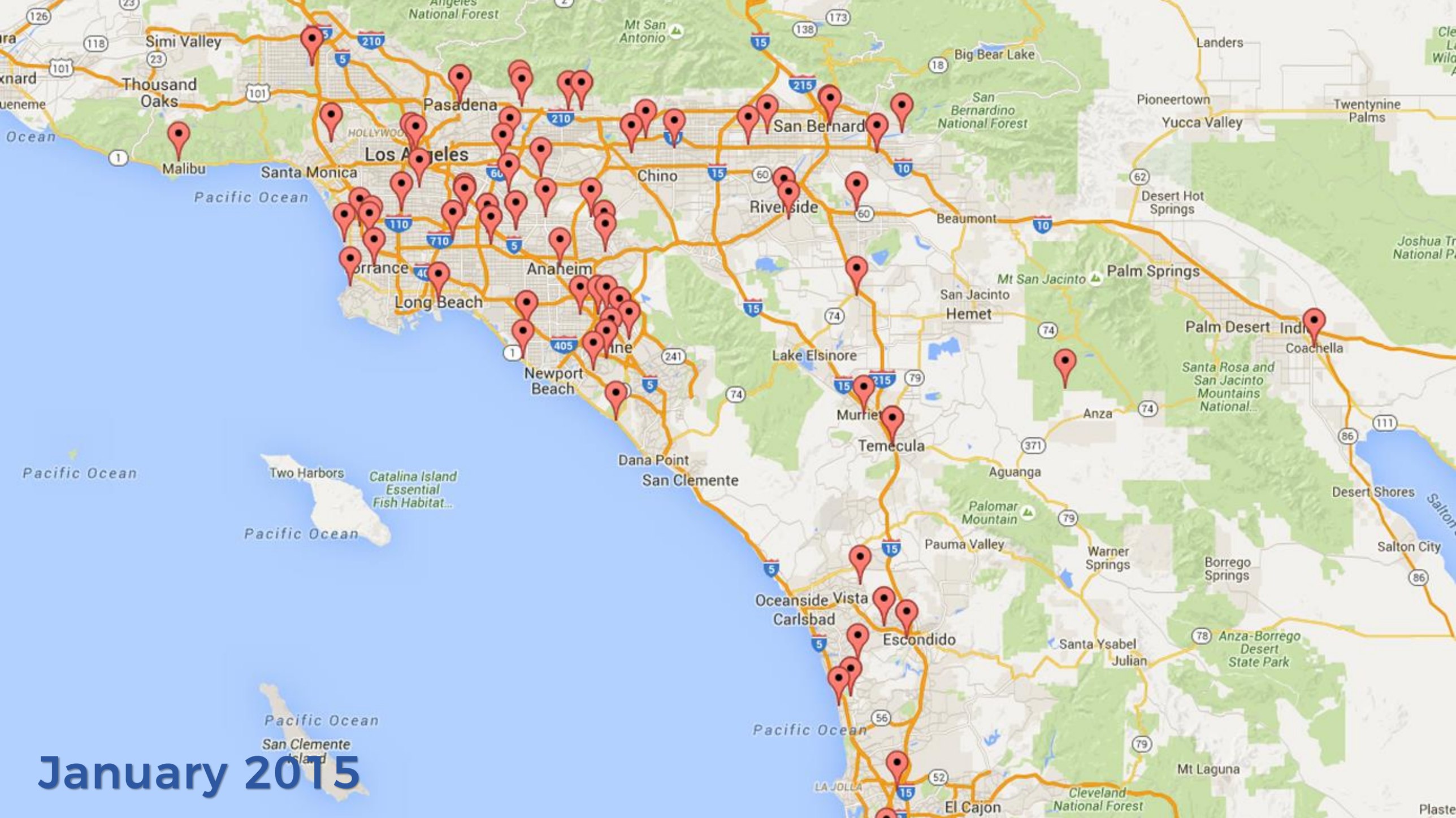

# October 2014



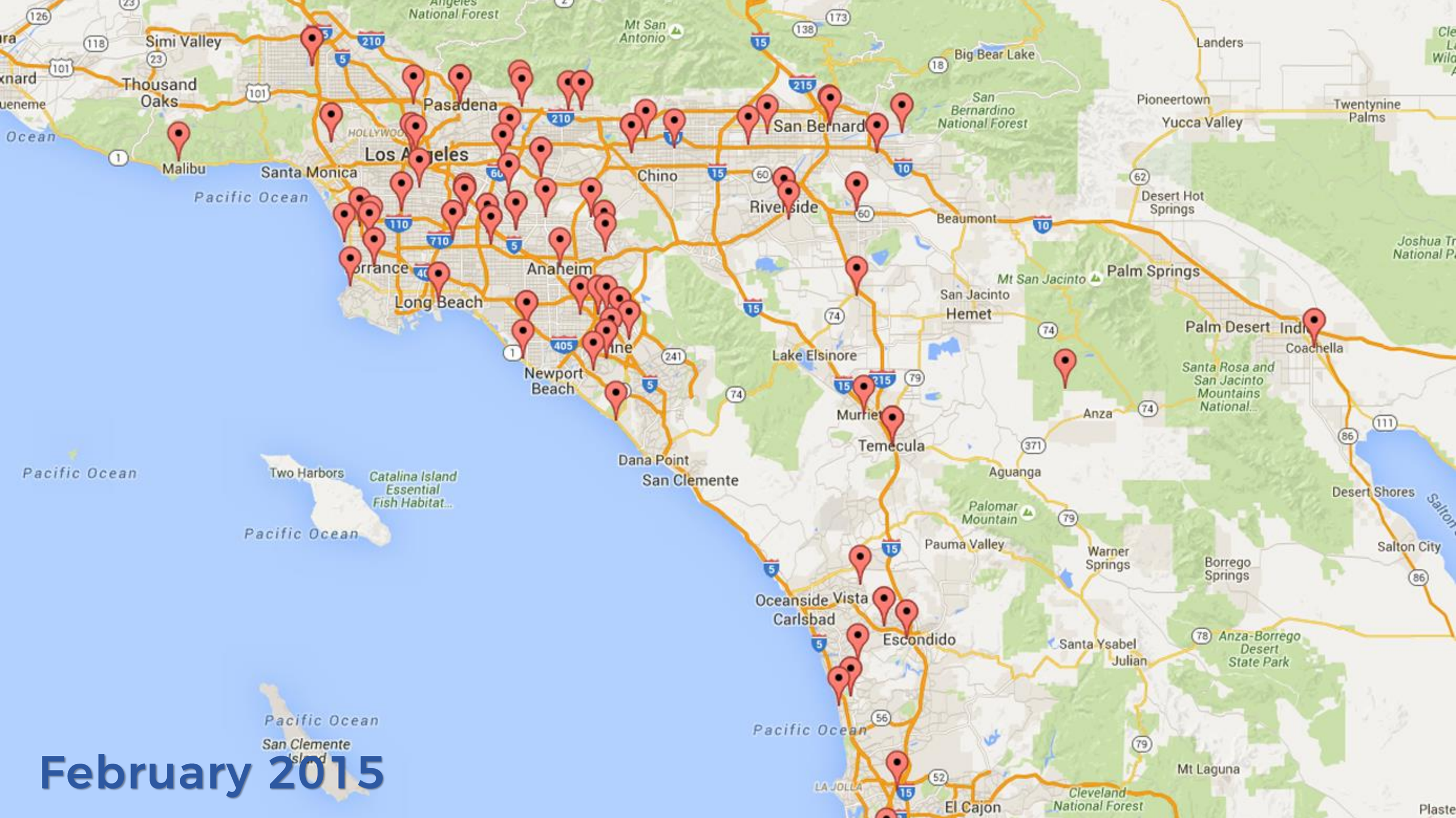

# November 2014



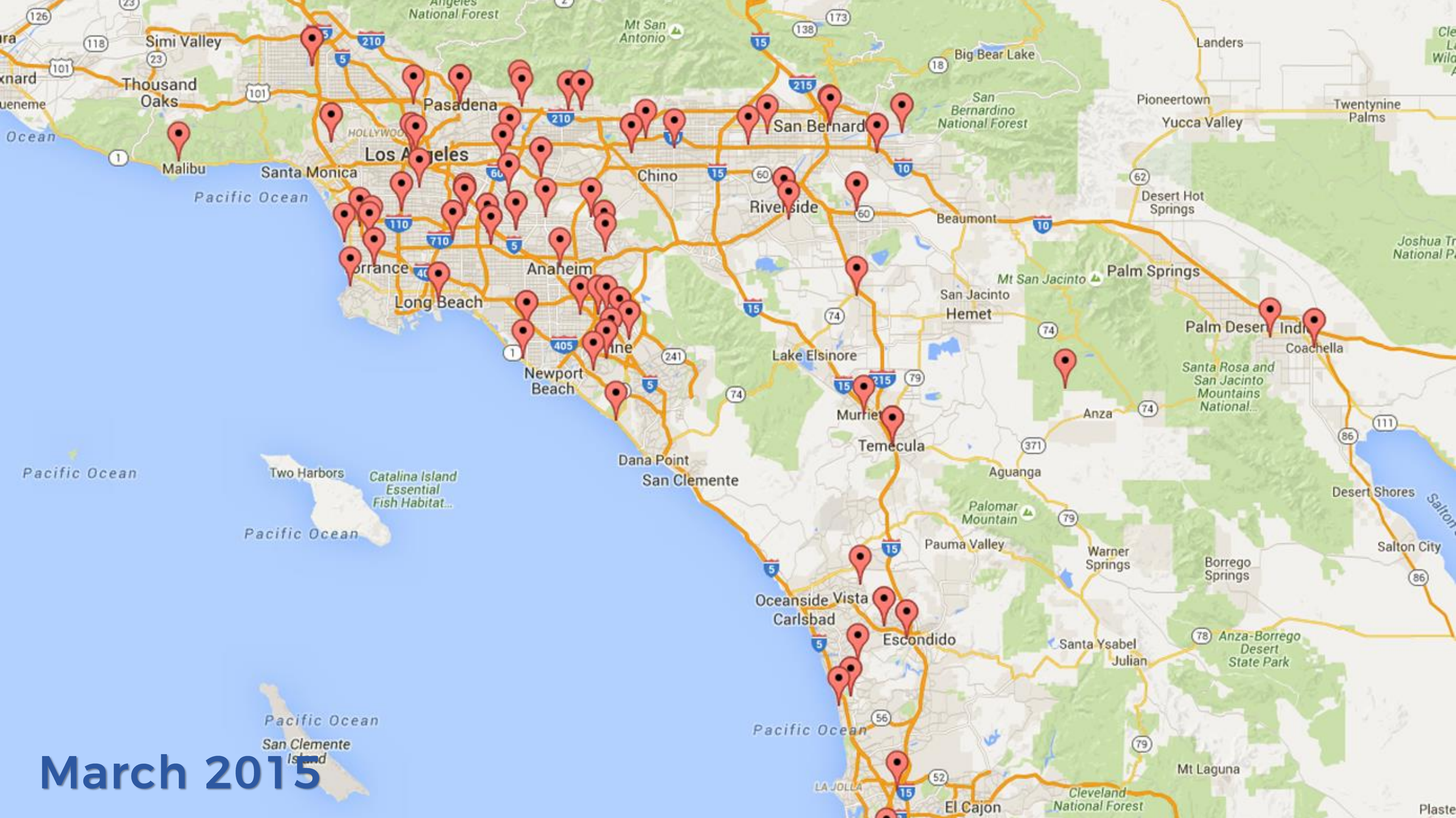

# December 2014



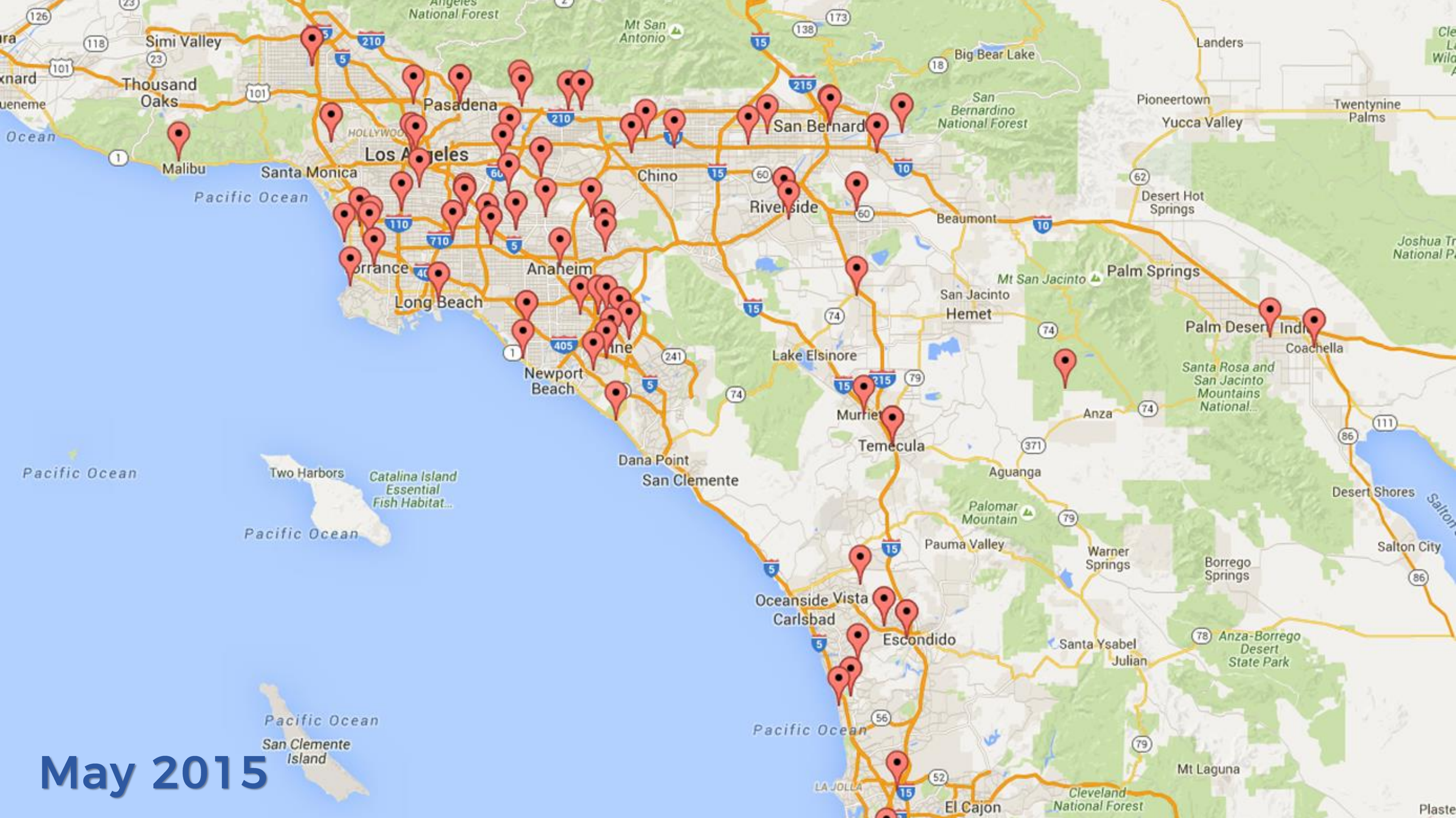

# January 2015



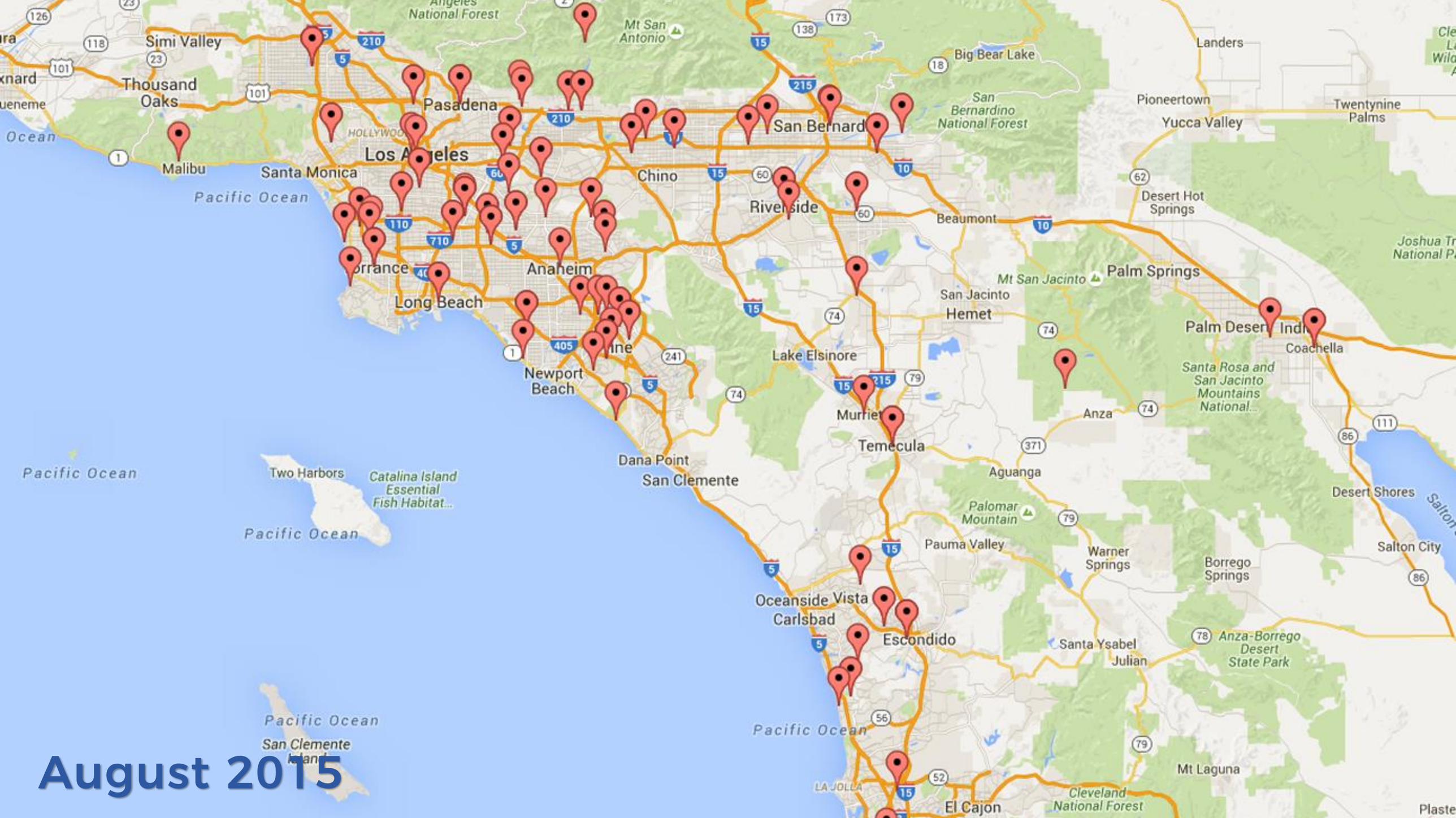

# February 2015


Simi Valley
Thousand Oaks
Malibu
Santa Monica
Pasadena
Los Angeles
Chino
San Bernardino
Big Bear Lake
Landers
Pioneertown
Yucca Valley
Twentynine Palms
Riverside
Beaumont
Desert Hot Springs
Palm Springs
San Jacinto
Hemet
Lake Elsinore
Anaheim
Long Beach
Newport Beach
Dana Point
San Clemente
Temecula
Murrieta
Anza
Aguanga
Coachella
Desert Shores
Salton City
Pauma Valley
Warner Springs
Borrego Springs
Oceanside
Vista
Carlsbad
Escondido
Santa Ysabel
Julian
Mt Laguna
El Cajon
Cleveland National Forest
Anza-Borrego Desert State Park
Santa Rosa and San Jacinto Mountains National...
Palomar Mountain
Mt San Jacinto
Mt San Antonio
Angeles National Forest
San Bernardino National Forest
Pacific Ocean
Two Harbors
Catalina Island Essential Fish Habitat...
San Clemente Island
LA JOLLA

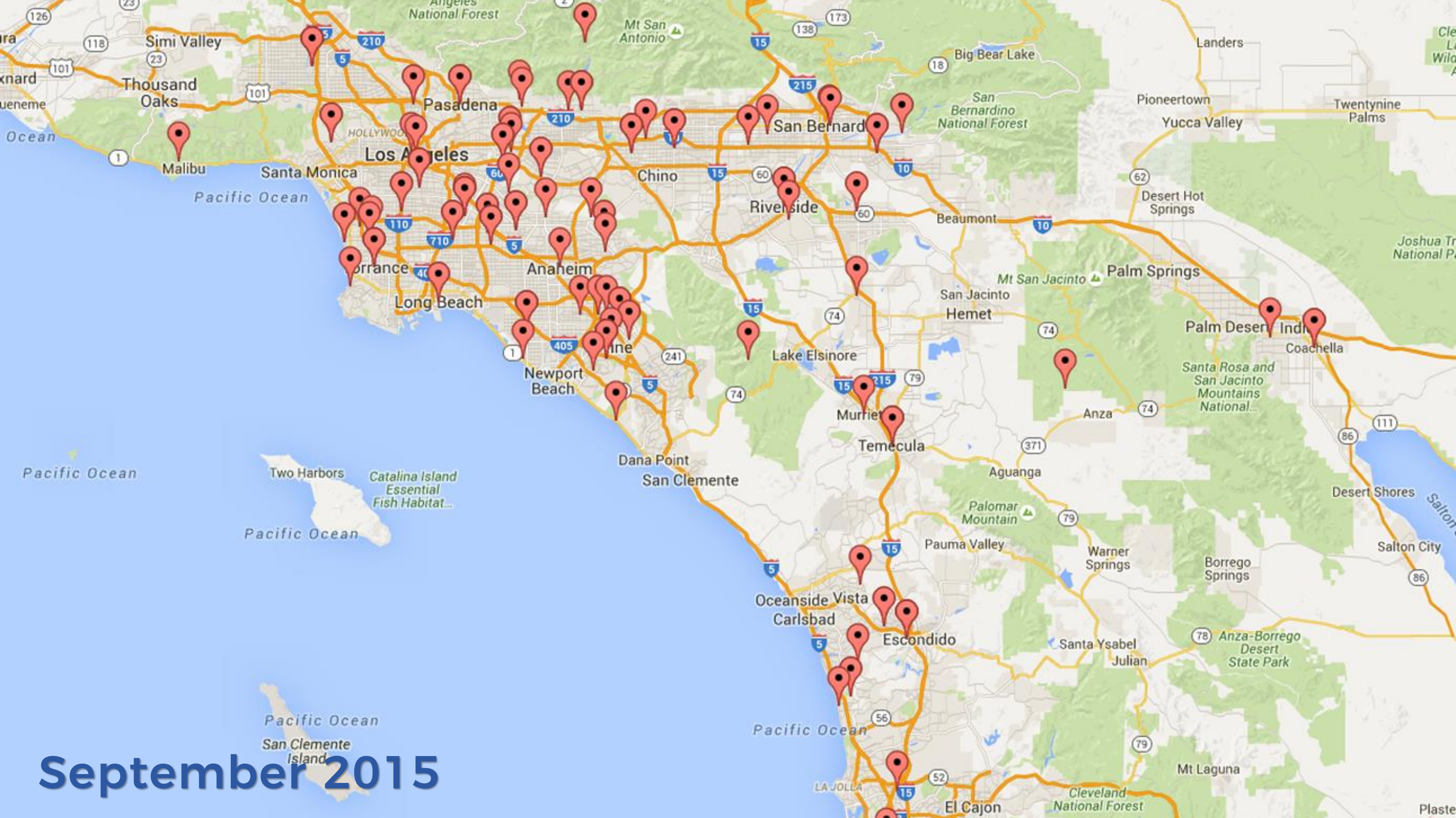
# March 2015


Simi Valley
Thousand Oaks
Malibu
Santa Monica
Pasadena
Los Angeles
Chino
San Bernardino
Riverside
Beaumont
Big Bear Lake
San Bernardino National Forest
Landers
Pioneertown
Yucca Valley
Twentynine Palms
Desert Hot Springs
Palm Springs
Mt San Jacinto
San Jacinto
Hemet
Palm Desert
Coachella
Santa Rosa and San Jacinto Mountains National...
Anza
Aguanga
Temecula
Murrieta
Lake Elsinore
Anaheim
Long Beach
Newport Beach
Dana Point
San Clemente
Pacific Ocean
Two Harbors
Catalina Island Essential Fish Habitat...
Palomar Mountain
Pauma Valley
Warner Springs
Borrego Springs
Desert Shores
Salton City
Oceanside
Vista
Carlsbad
Escondido
Santa Ysabel
Julian
Anza-Borrego Desert State Park
San Clemente Island
Mt Laguna
El Cajon
Cleveland National Forest
LA JOLLA

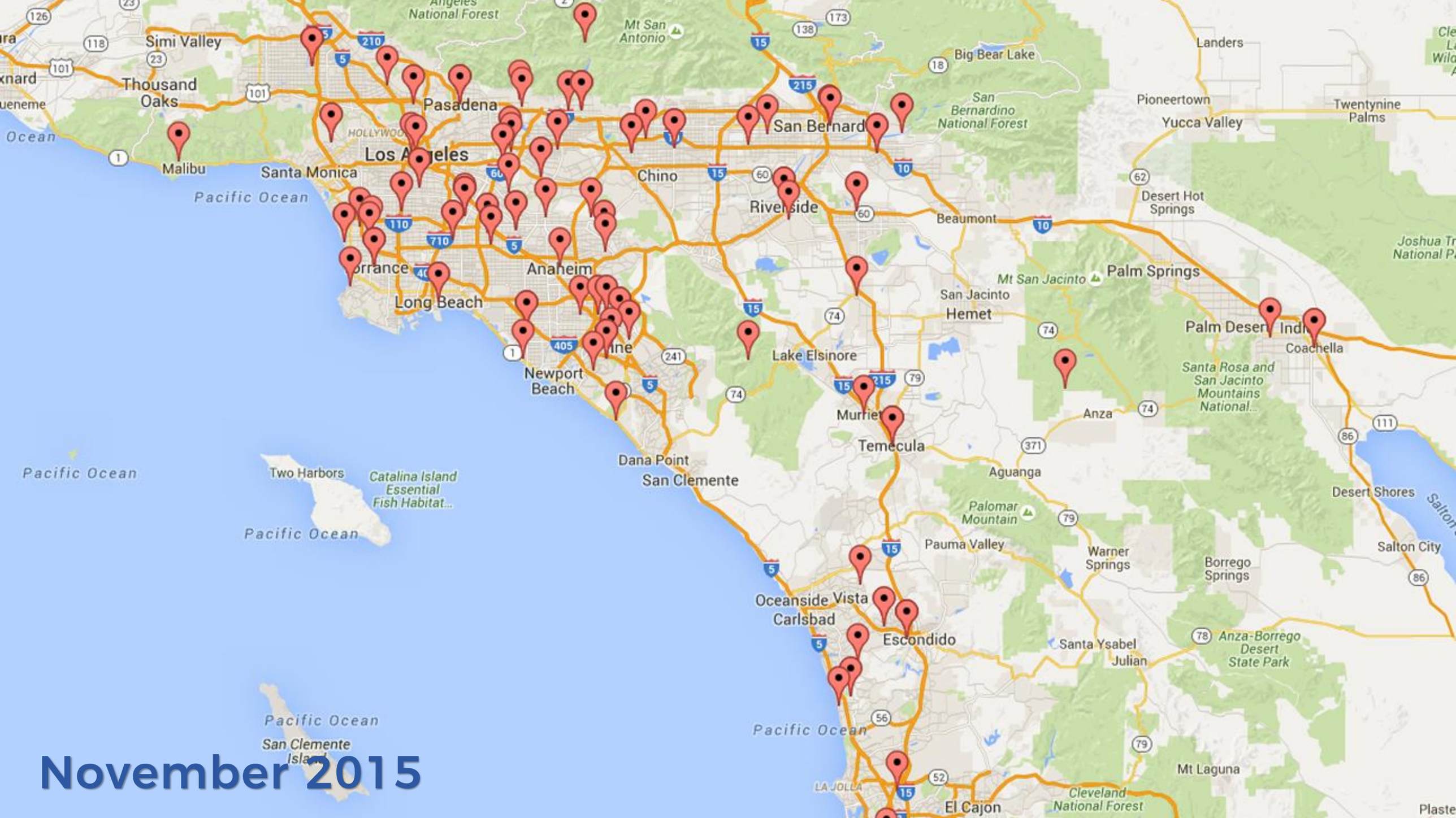
# May 2015


Simi Valley
Thousand Oaks
Malibu
Pasadena
Santa Monica
Los Angeles
Pacific Ocean
Chino
San Bernardino
Big Bear Lake
Landers
Pioneertown
Yucca Valley
Twentynine Palms
Riverside
Beaumont
Desert Hot Springs
Palm Springs
Mt San Jacinto
San Jacinto
Hemet
Lake Elsinore
Anaheim
Long Beach
Newport Beach
Dana Point
San Clemente
Two Harbors
Catalina Island Essential Fish Habitat...
Temecula
Murrieta
Anza
Aguanga
Palomar Mountain
Pauma Valley
Warner Springs
Borrego Springs
Santa Rosa and San Jacinto Mountains National...
Coachella
Desert Shores
Salton City
Oceanside
Vista
Carlsbad
Escondido
Santa Ysabel
Julian
Anza-Borrego Desert State Park
Mt Laguna
Cleveland National Forest
El Cajon
LA JOLLA

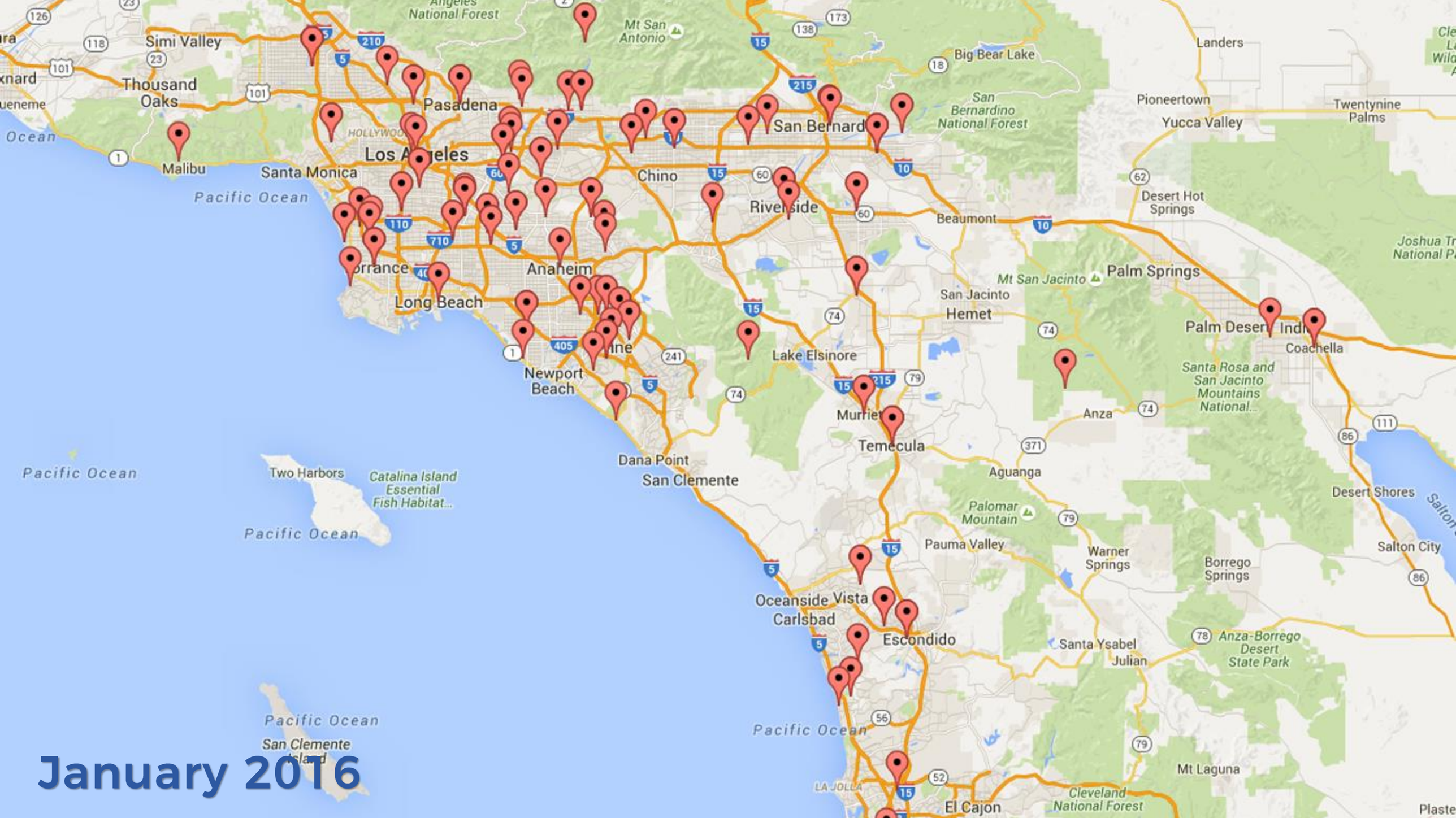
# August 2015



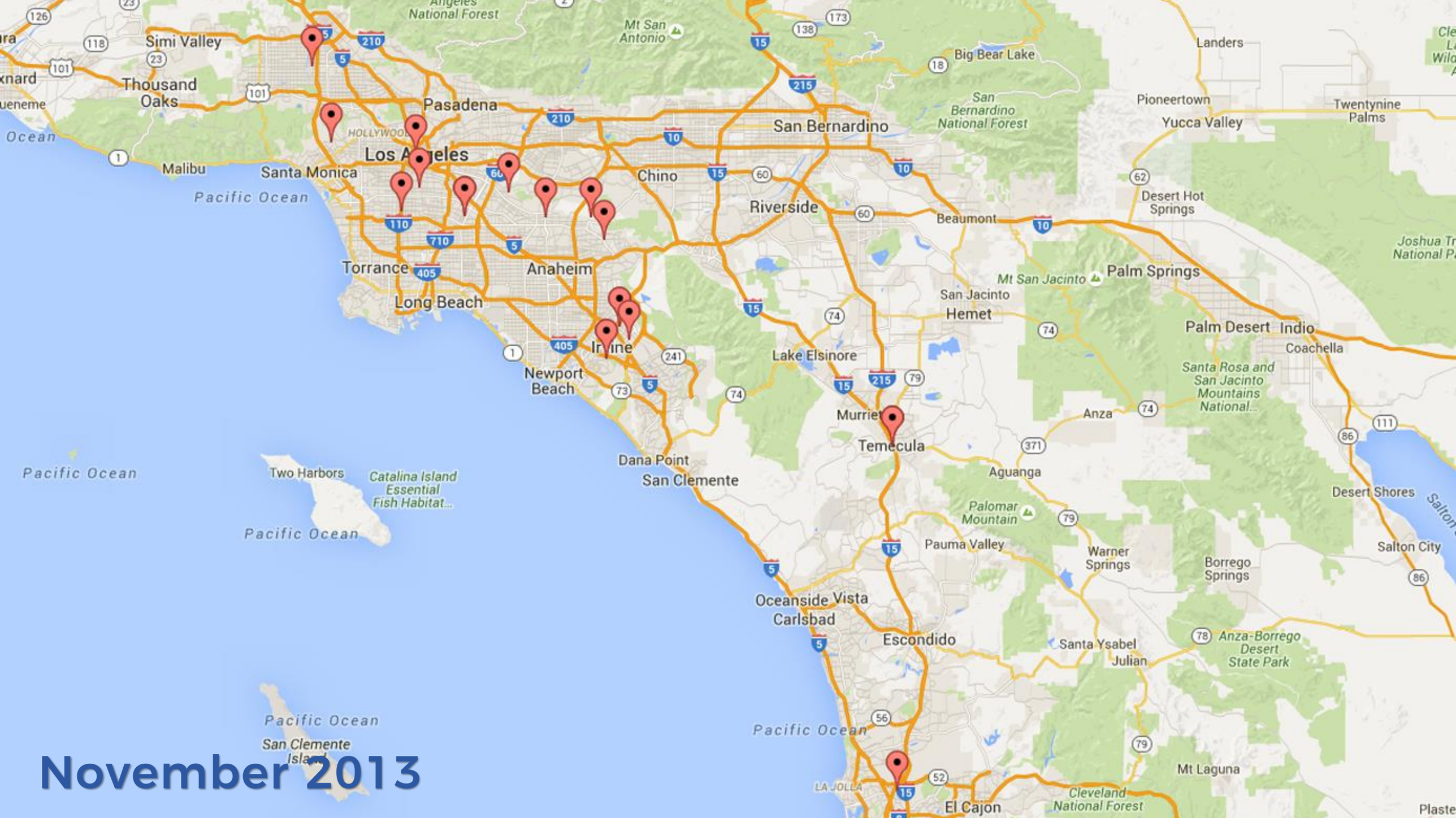

# September 2015



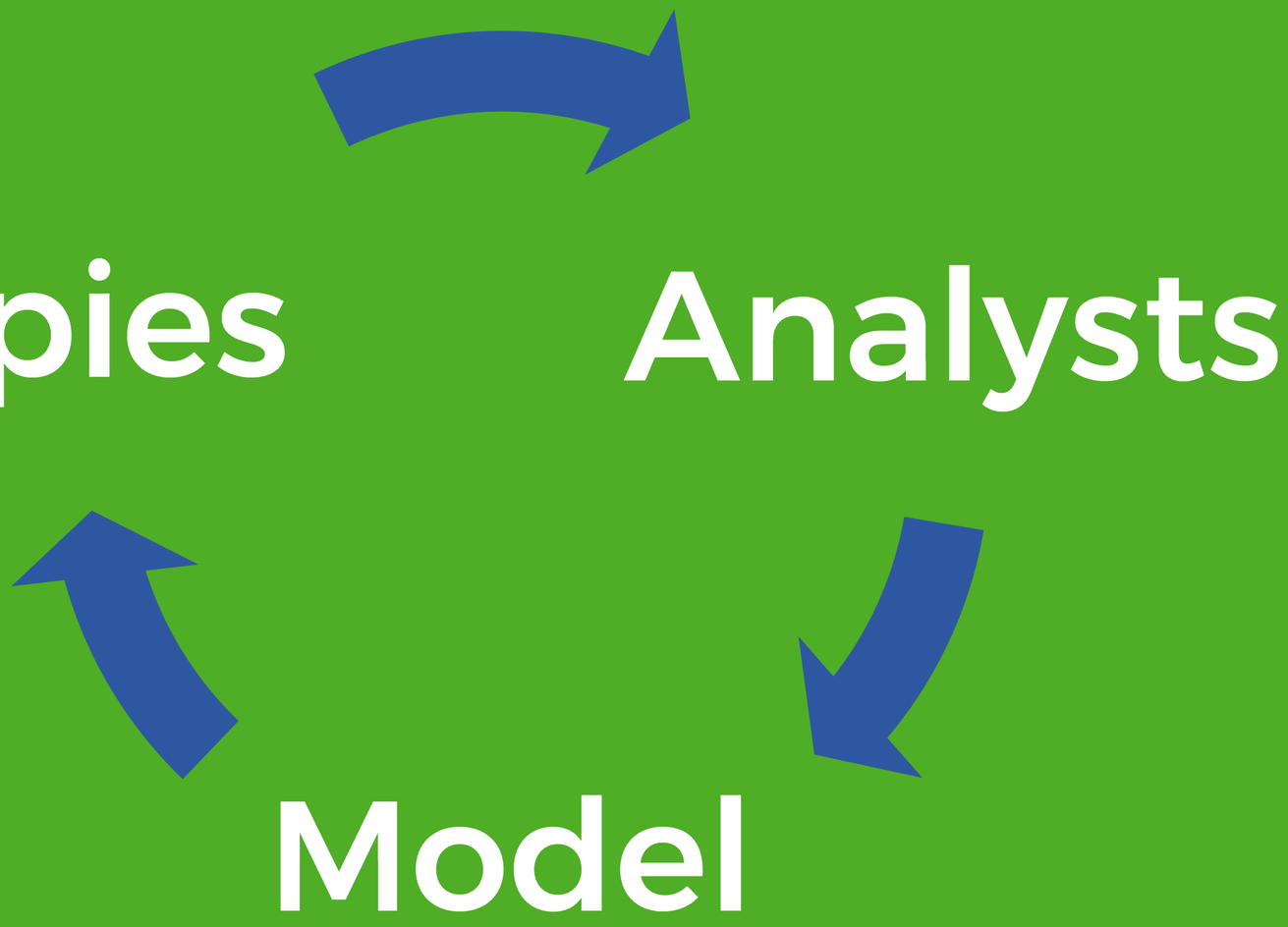

# November 2015




# January 2016




# November 2013


Spies
Analysts
Model

All models are wrong, but some are useful.

GEORGE E. P. BOX

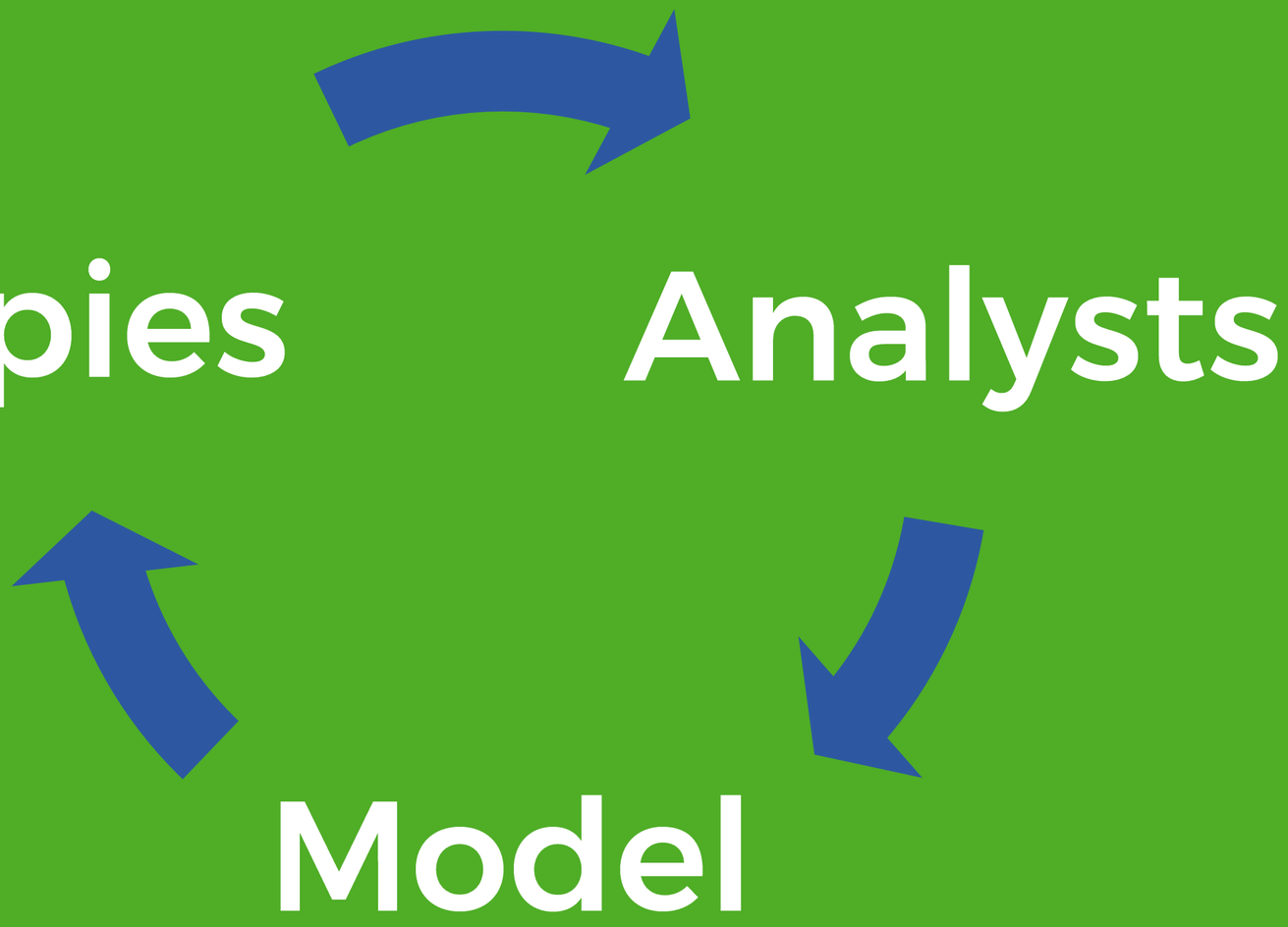
# Classic Mix

**20 Singles**

LAY'S® Classic Potato Chips, DORITOS® Nacho Cheese Flavored Tortilla Chips, DORITOS® COOL RANCH® Flavored Tortilla Chips, CHEETOS® Crunchy Cheese Flavored Snacks, SUNCHIPS® Original Multigrain Snacks, FRITOS® Original Corn Chips (All 1 OZ. Each)

20 INDIVIDUAL BAGS: 1 OZ. EACH, TOTAL NET WT. 20 OZ. (1 LB. 4 OZ.) 567 g

⚠ WARNING: PREVENT ENTANGLEMENT AND STRANGULATION. KEEP THIS BAG AWAY FROM YOUNG CHILDREN. IT IS NOT A TOY.


Spies
Analysts
Model

# THINKING TIME

RobertKaplinsky.com

**Robert Kaplinsky**
@robertkaplinsky

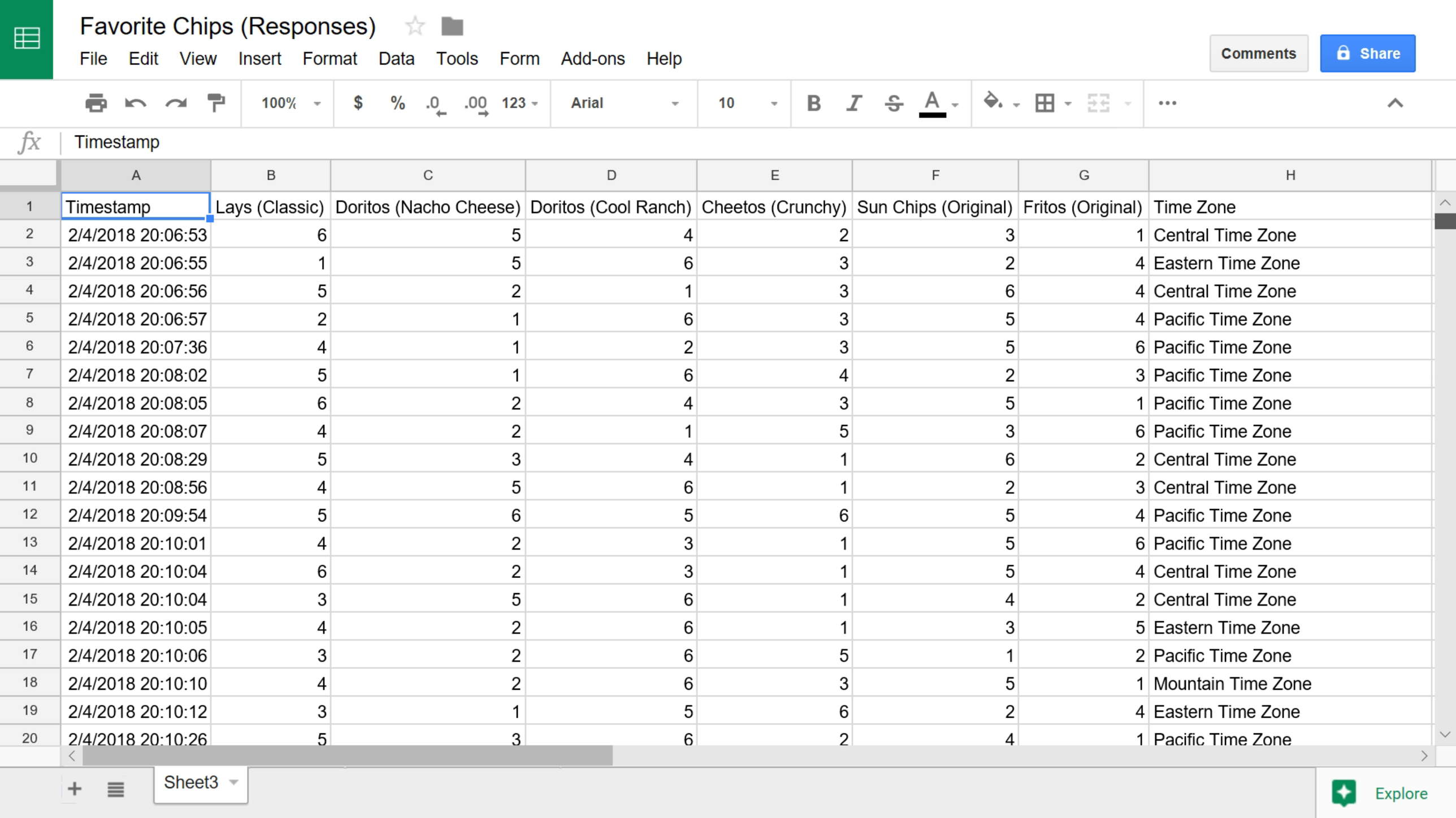
Hey #MTBoS, can you do me a favor and complete this 3 question anonymous survey about your favorite chips? I need data for a presentation. Please RT.
goo.gl/forms/etPtujII… #iteachmath

**Favorite Chips**
Please complete this anonymous survey. I'll be using this data in a presentation.
docs.google.com

8:05 PM - 4 Feb 2018

**63** Retweets **45** Likes

18 63 45




| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | Timestamp | Lays (Classic) | Doritos (Nacho Cheese) | Doritos (Cool Ranch) | Cheetos (Crunchy) | Sun Chips (Original) | Fritos (Original) | Time Zone |
| 2 | 2/4/2018 20:06:53 | 6 | 5 | 4 | 2 | 3 | 1 | Central Time Zone |
| 3 | 2/4/2018 20:06:55 | 1 | 5 | 6 | 3 | 2 | 4 | Eastern Time Zone |
| 4 | 2/4/2018 20:06:56 | 5 | 2 | 1 | 3 | 6 | 4 | Central Time Zone |
| 5 | 2/4/2018 20:06:57 | 2 | 1 | 6 | 3 | 5 | 4 | Pacific Time Zone |
| 6 | 2/4/2018 20:07:36 | 4 | 1 | 2 | 3 | 5 | 6 | Pacific Time Zone |
| 7 | 2/4/2018 20:08:02 | 5 | 1 | 6 | 4 | 2 | 3 | Pacific Time Zone |
| 8 | 2/4/2018 20:08:05 | 6 | 2 | 4 | 3 | 5 | 1 | Pacific Time Zone |
| 9 | 2/4/2018 20:08:07 | 4 | 2 | 1 | 5 | 3 | 6 | Pacific Time Zone |
| 10 | 2/4/2018 20:08:29 | 5 | 3 | 4 | 1 | 6 | 2 | Central Time Zone |
| 11 | 2/4/2018 20:08:56 | 4 | 5 | 6 | 1 | 2 | 3 | Central Time Zone |
| 12 | 2/4/2018 20:09:54 | 5 | 6 | 5 | 6 | 5 | 4 | Pacific Time Zone |
| 13 | 2/4/2018 20:10:01 | 4 | 2 | 3 | 1 | 5 | 6 | Pacific Time Zone |
| 14 | 2/4/2018 20:10:04 | 6 | 2 | 3 | 1 | 5 | 4 | Central Time Zone |
| 15 | 2/4/2018 20:10:04 | 3 | 5 | 6 | 1 | 4 | 2 | Central Time Zone |
| 16 | 2/4/2018 20:10:05 | 4 | 2 | 6 | 1 | 3 | 5 | Eastern Time Zone |
| 17 | 2/4/2018 20:10:06 | 3 | 2 | 6 | 5 | 1 | 2 | Pacific Time Zone |
| 18 | 2/4/2018 20:10:10 | 4 | 2 | 6 | 3 | 5 | 1 | Mountain Time Zone |
| 19 | 2/4/2018 20:10:12 | 3 | 1 | 5 | 6 | 2 | 4 | Eastern Time Zone |
| 20 | 2/4/2018 20:10:26 | 5 | 3 | 6 | 2 | 4 | 1 | Pacific Time Zone |

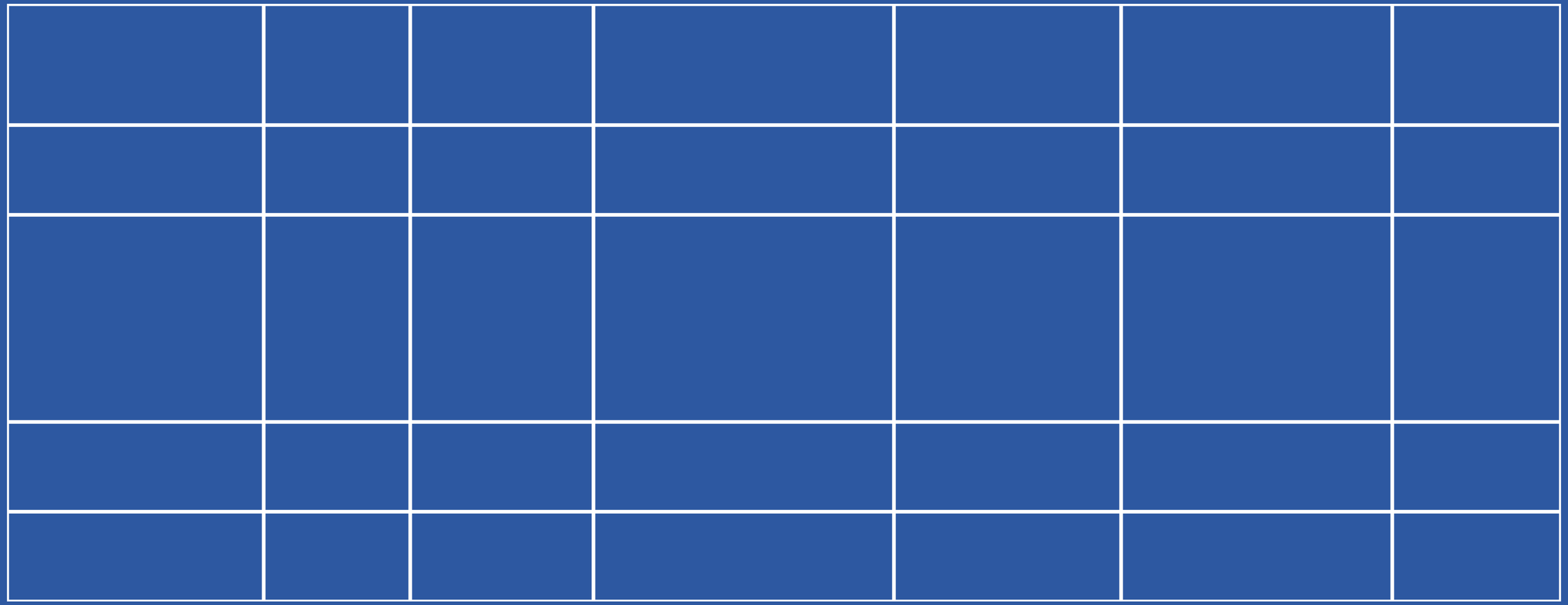
# THINKING TIME

- The available data includes:
  - Lays, Nacho Cheese Doritos, Cool Ranch Doritos, Cheetos, Sun Chips, and Fritos ranked from 1 to 6
  - Geographic region: West, Central, or Eastern

# ANALYSTS' JOB FOR THE TOP 1

1. Count all the first place votes for each chip type.
2. Divide the total first place votes for each chip type by the total number of votes.
3. Multiply that fraction by 20 to find how many bags there would be in a twenty pack, rounding as necessary.

# ANALYSTS' EXAMPLE



# ANALYSTS' JOB FOR THE TOP 4

1. Count all the first, second, third, and fourth place votes for each chip type.
2. Multiply the first place votes by four, the second place votes by three, the third place votes by two, and the fourth place votes by one.
3. Add the weighted votes for each chip type and divide by the total number of weighted votes.
4. Divide the weighted votes for each chip type by the total number of votes.
5. Multiply that fraction by 20 to find how many bags there would be in a twenty pack, rounding as necessary.

# ANALYSTS' EXAMPLE

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

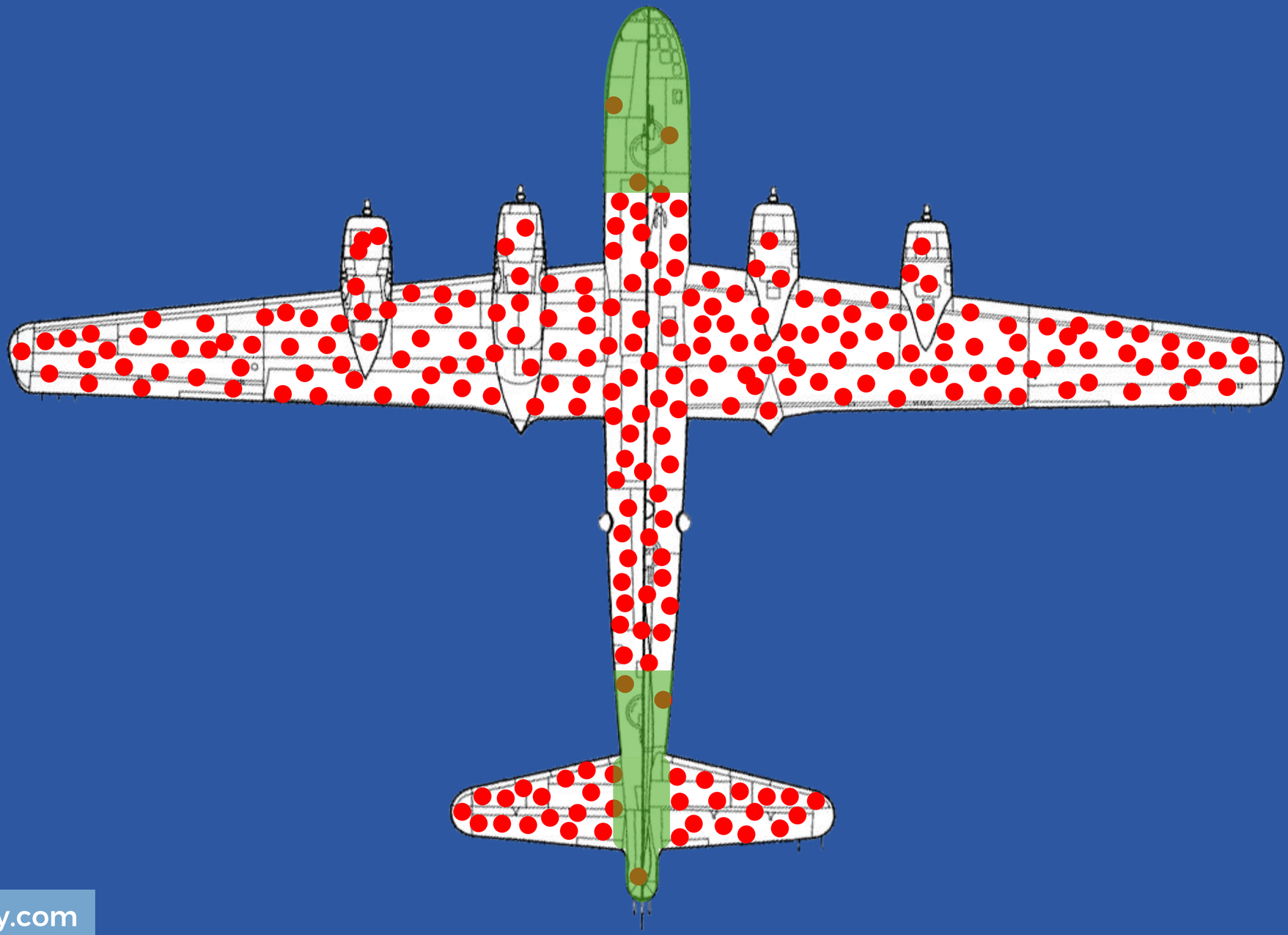
# CHIP BAG RESULTS

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

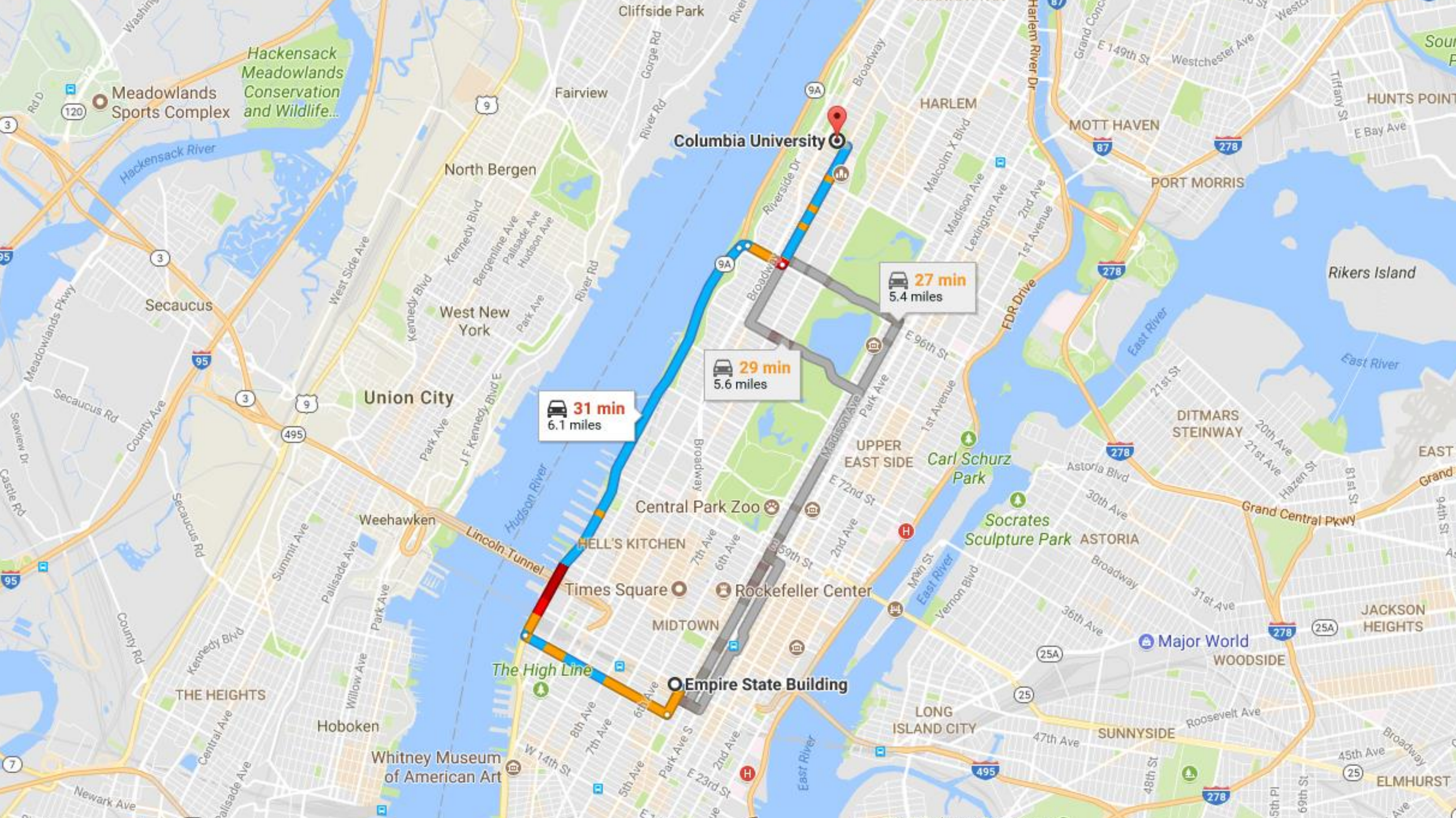
# GOALS

- [x] HOW DO WE MAKE SENSE OF MATH MODELING?
- [ ] IS IT JUST ANSWERING QUESTIONS?
- [ ] HOW DO YOU PROFIT FROM  MATH MODELING?
- [ ] HOW DO WE HELP OUR STUDENTS IMPROVE?
- [ ] WHERE CAN WE FIND MORE RESOURCES?

224612



- ~~How do we protect our planes?~~
- ~~Which parts of the plane are being hit by the most bullets?~~
- Which parts of the plane are the most critical to protect?



Columbia University
27 min
5.4 miles
29 min
5.6 miles
31 min
6.1 miles
Empire State Building
Cliffside Park
Fairview
North Bergen
Hackensack Meadowlands Conservation and Wildlife...
Meadowlands Sports Complex
Hackensack River
Secaucus
West New York
Union City
Weehawken
Lincoln Tunnel
Hudson River
HELL'S KITCHEN
Central Park Zoo
Times Square
Rockefeller Center
MIDTOWN
The High Line
THE HEIGHTS
Hoboken
Whitney Museum of American Art
HARLEM
MOTT HAVEN
PORT MORRIS
Rikers Island
East River
UPPER EAST SIDE
Carl Schurz Park
Socrates Sculpture Park
ASTORIA
DITMARS STEINWAY
Major World
WOODSIDE
JACKSON HEIGHTS
LONG ISLAND CITY
SUNNYSIDE
ELMHURST
HUNTS POINT
FDR Drive
Harlem River Dr
Grand Central Pkwy

- ~~How do we find the fastest route for each customer?~~
- How do we find the fastest route for each customer without impacting our other customers?

# Classic Mix

**20 Singles**

4 LAY'S® Classic Potato Chips, 4 DORITOS® Nacho Cheese Flavored Tortilla Chips, 2 DORITOS® COOL RANCH® Flavored Tortilla Chips, 4 CHEETOS® Crunchy Cheese Flavored Snacks, 2 SUNCHIPS® Original Multigrain Snacks, 4 FRITOS® Original Corn Chips (All 1 OZ. Each)

20 INDIVIDUAL BAGS: 1 OZ. EACH, TOTAL NET WT. 20 OZ. (1 LB. 4 OZ.) 567 g

⚠ WARNING: PREVENT ENTANGLEMENT AND STRANGULATION. KEEP THIS BAG AWAY FROM YOUNG CHILDREN. IT IS NOT A TOY.

- ~~How many of each flavor should we put in a package?~~
- ~~How many of each flavor should we put in a package for each region?~~
- How can we determine if the extra cost of creating different packages will make us more money?

Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later.

# CCSS MATH PRACTICE 4

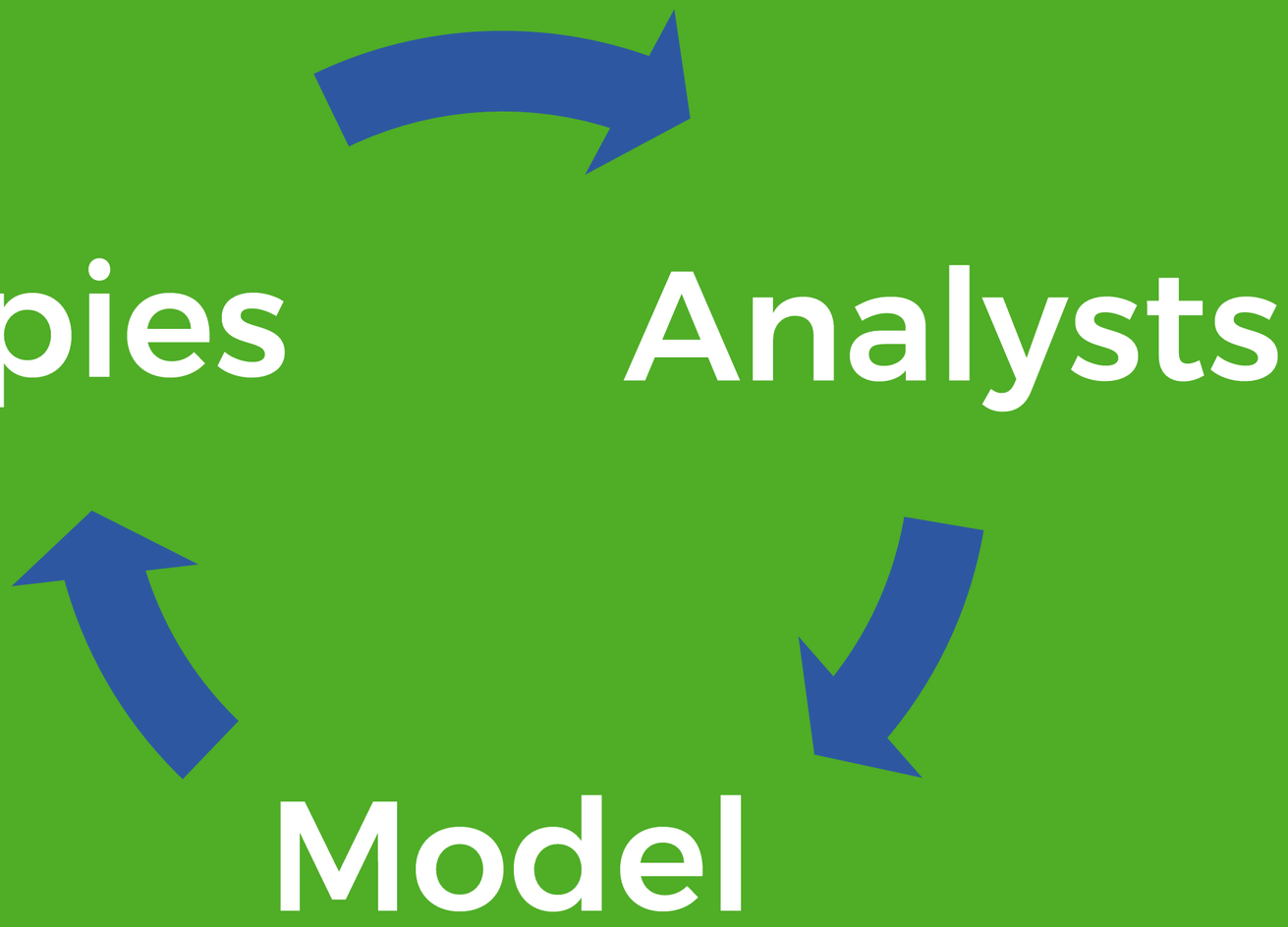
They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

# CCSS MATH PRACTICE 4

# GOALS

- ☑ HOW DO WE MAKE SENSE OF MATH MODELING?
- ☑ IS IT JUST ANSWERING QUESTIONS?
- ☐ HOW DO YOU PROFIT FROM  MATH MODELING?
- ☐ HOW DO WE HELP OUR STUDENTS IMPROVE?
- ☐ WHERE CAN WE FIND MORE RESOURCES?

TARGET
TARGET PARKING


Spies
Analysts
Model

# They used 25 products for a pregnancy prediction' score including:

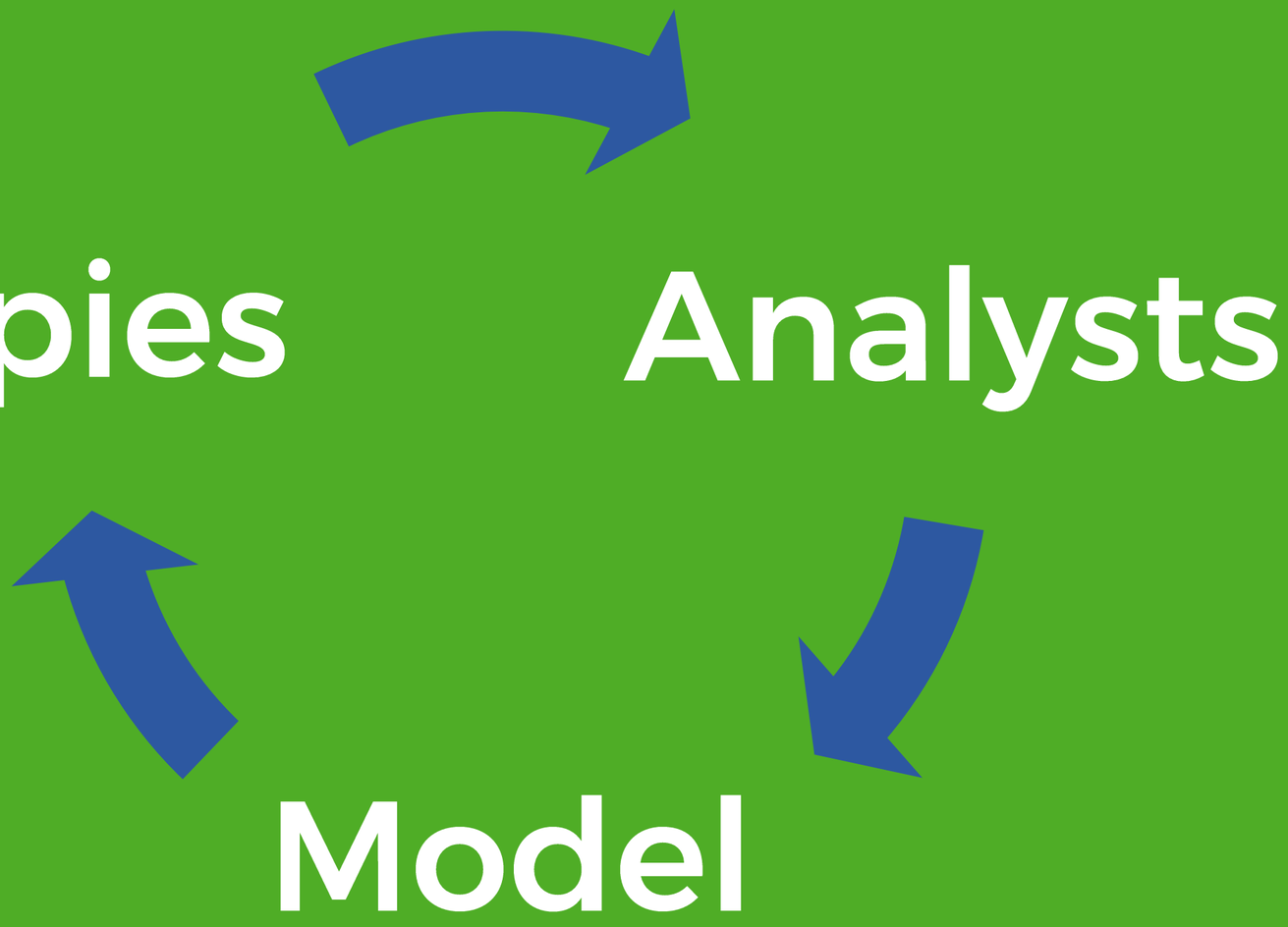
- unscented lotion
- mineral supplements
- cotton balls

Source: New York Times

# ANALYSTS' EXAMPLE

1. Add the number of bottles of unscented lotion, jars of mineral supplements, and bags of cotton balls.
2. Multiply that times the day of the week.
3. Click your heels twice.
4. Repeat the phrase "There's no place like home!"

UNITED


Spies
Analysts
Model

# Priority is determined by:

- passenger's fare class
- itinerary
- frequent flyer program membership
- check-in time

Source: United Airlines

Search

Robert | Home

Robert Kaplinsky

- News Feed
- Messenger
- Watch
- Marketplace

**Explore**

- Pages
- Events
- Groups
- Friend Lists
- On This Day 3
- Insights
- Games 7
- Fundraisers
- Live Video
- Pokes
- See More...

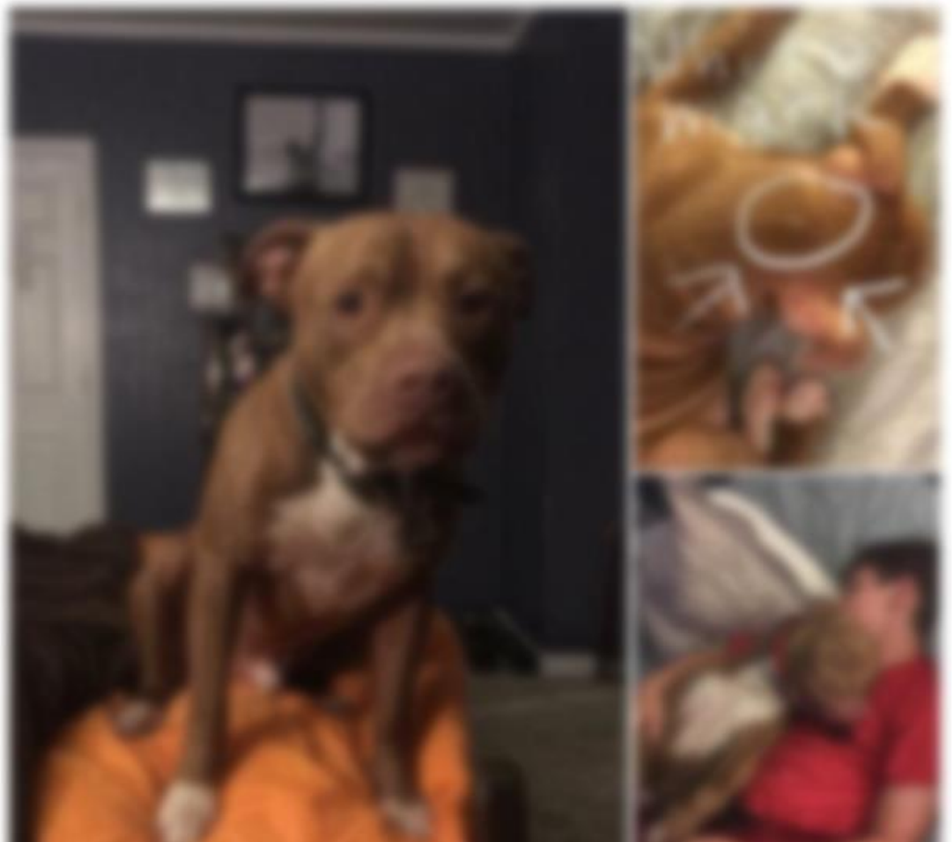
**Create**

Ad · Page · Group · Event · Fundraiser

Make Post | Photo/Video Album | Live Video

What's on your mind, Robert?

Photo/Video | Feeling/Activity | ...

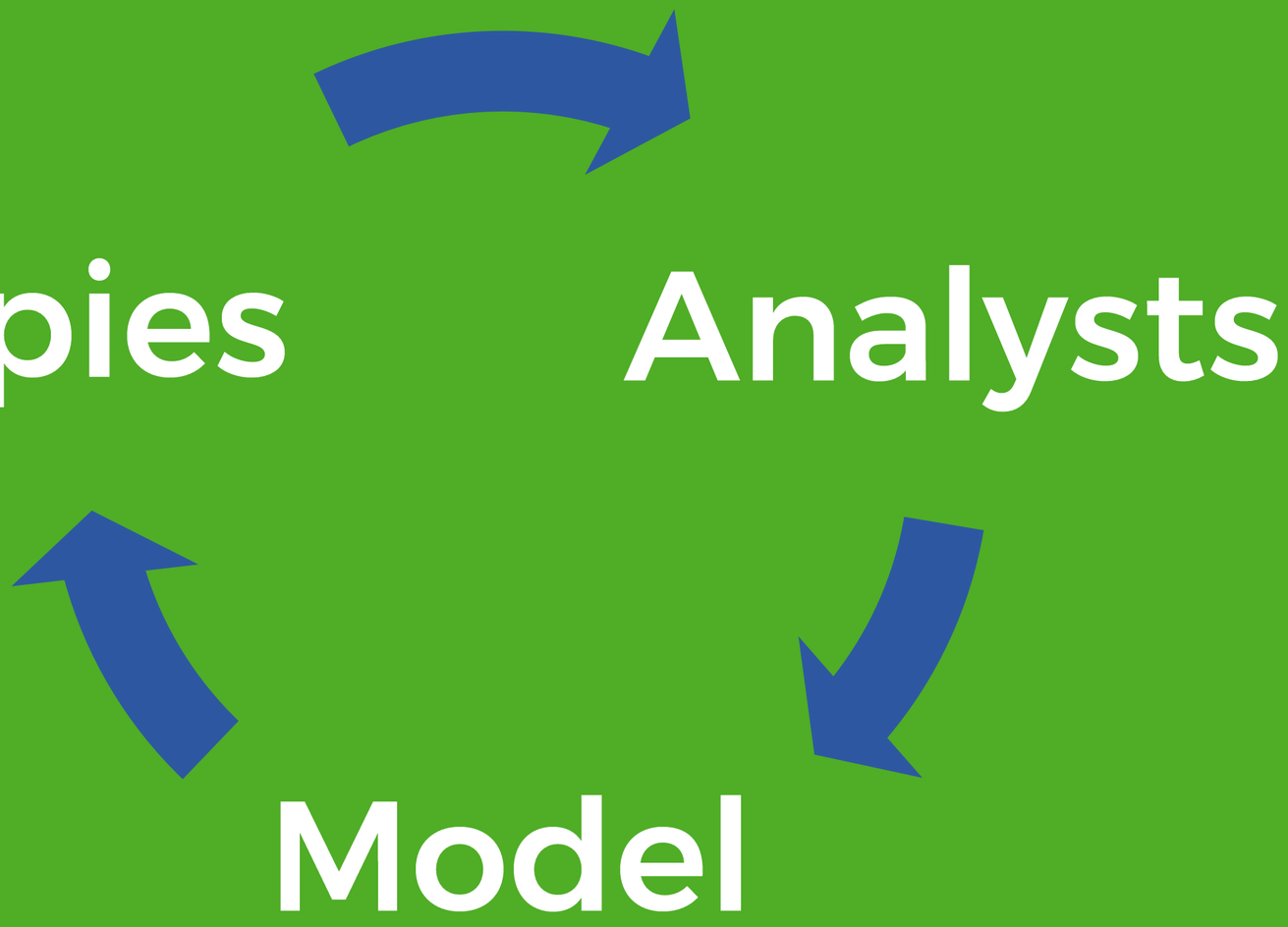


**Trending**

**Watchlist: Latest Episodes**

See All

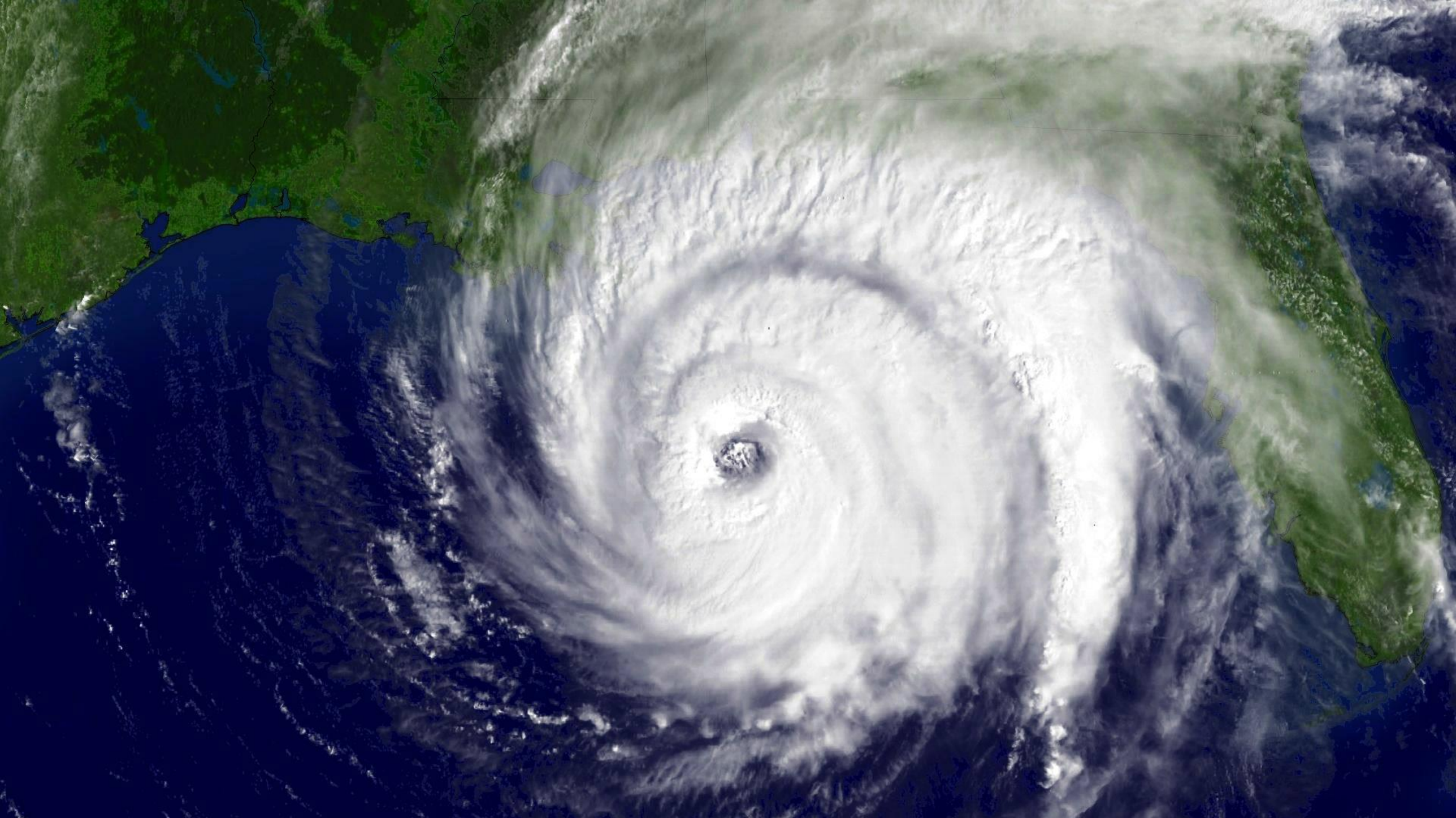
**Sponsored** Create Ad

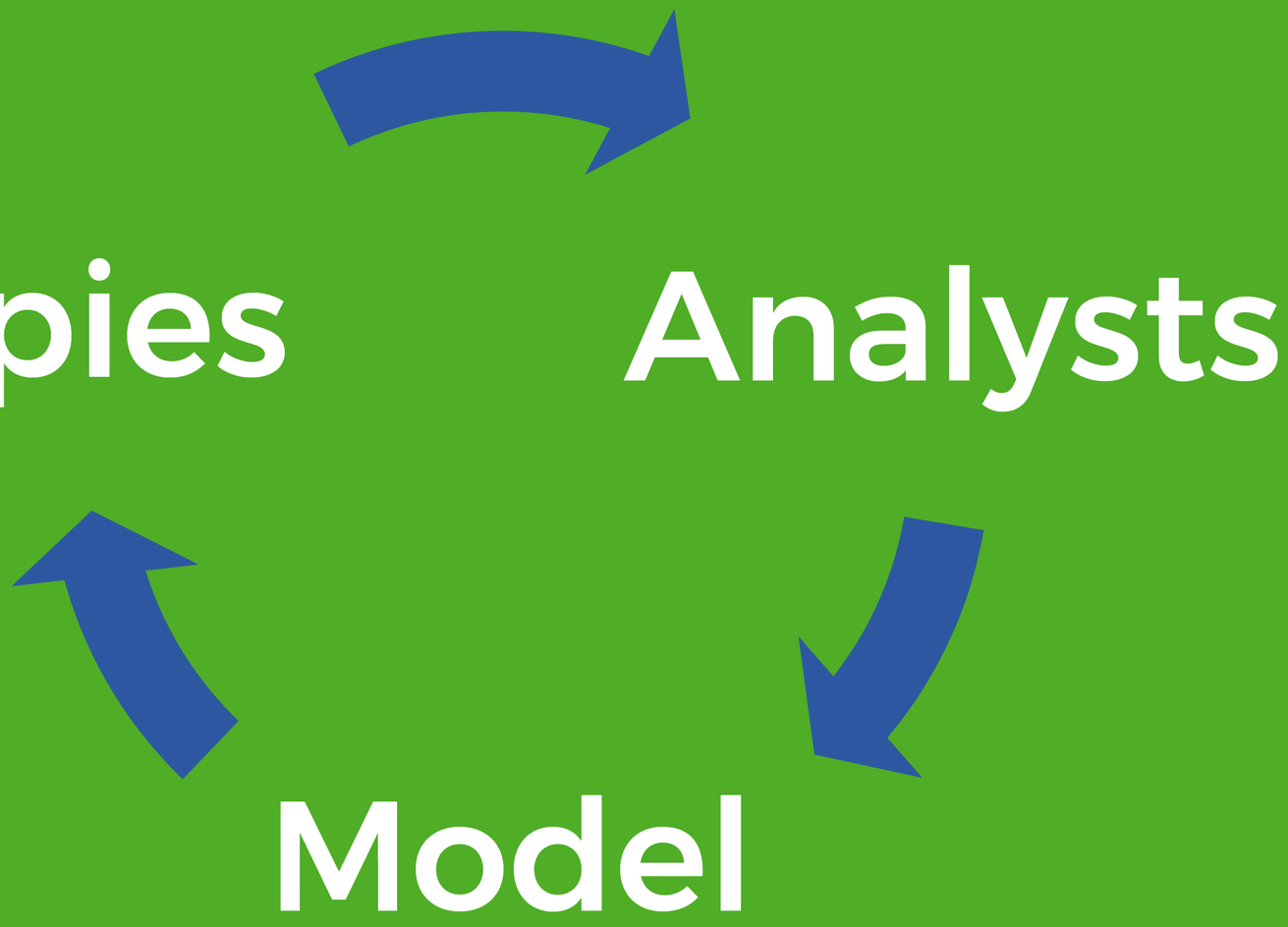

Spies
Analysts
Model

# The stories that show in your News Feed are influenced by:

- friends you interact with the most
- the number of comments and likes a post receives
- what kind of story it is (ex: photo, video, status update)

Source: Facebook




Spies
Analysts
Model

WAFFLE HOUSE
WAFFLE HOUSE

# The index has three levels:

- Green: full menu - restaurant has power and damage is limited.
- Yellow: limited menu - no power or only power from a generator, or food supplies may be low.
- Red: the restaurant is closed - indicating severe damage.

Source: Wikipedia

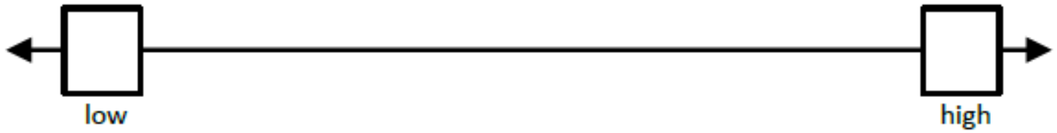
# MORE EXAMPLES

- How does US News and World Reports rank colleges?
- How does Google know which results to show?
- How do sports teams know who to draft?
- How does SpaceX make boosters land standing up?
- How does Zillow estimate home prices?
- How does Pandora know what music to play?
- How did the BCS rank college football teams?
- How do they figure out who should speak at a conference?

# GOALS

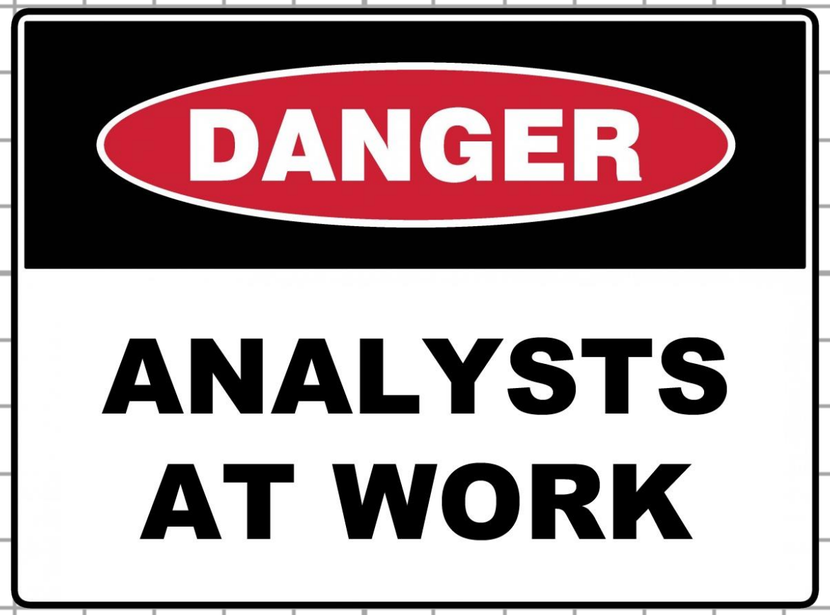
- [x] HOW DO WE MAKE SENSE OF MATH MODELING?
- [x] IS IT JUST ANSWERING QUESTIONS?
- [x] HOW DO YOU PROFIT FROM  MATH MODELING?
- [ ] HOW DO WE HELP OUR STUDENTS IMPROVE?
- [ ] WHERE CAN WE FIND MORE RESOURCES?

Name: _____ Period: _____ Date: _____

| What problem are you trying to figure out? | What estimates do you have? |
| --- | --- |
| |  Place your estimate on the number line. |
| What info do you already know about the problem? | What info do you need about the problem? |
| | |
| What is your conclusion? How did you reach that conclusion? | |
| | |

TOP SECRET! SPIES ONLY

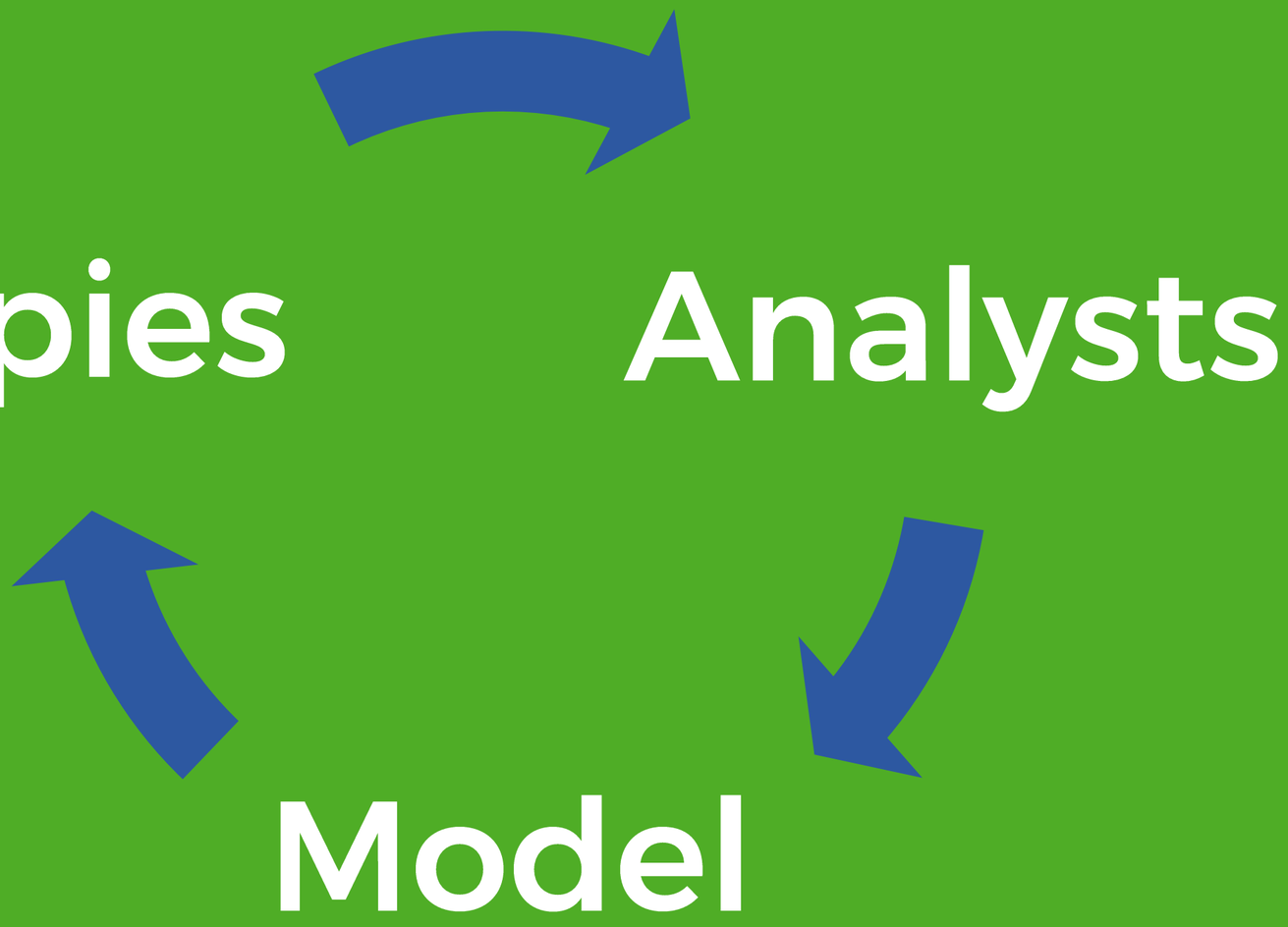
Your work



# MODELING EXAMPLES

- ❑ MIDDLE SCHOOL
- ❑ HIGH SCHOOL

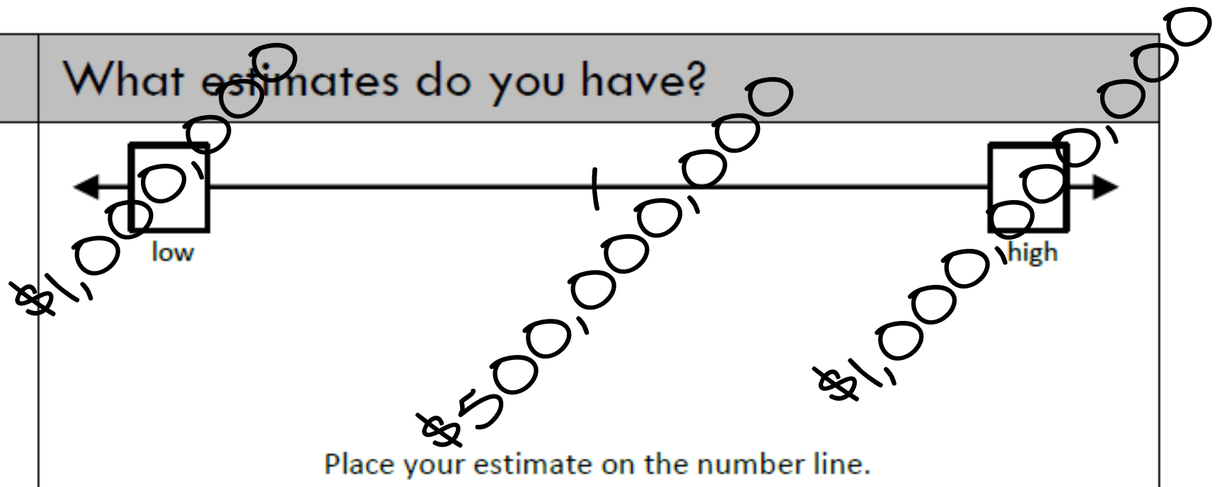
IVE
FOX NEWS
Junction


Spies
Analysts
Model

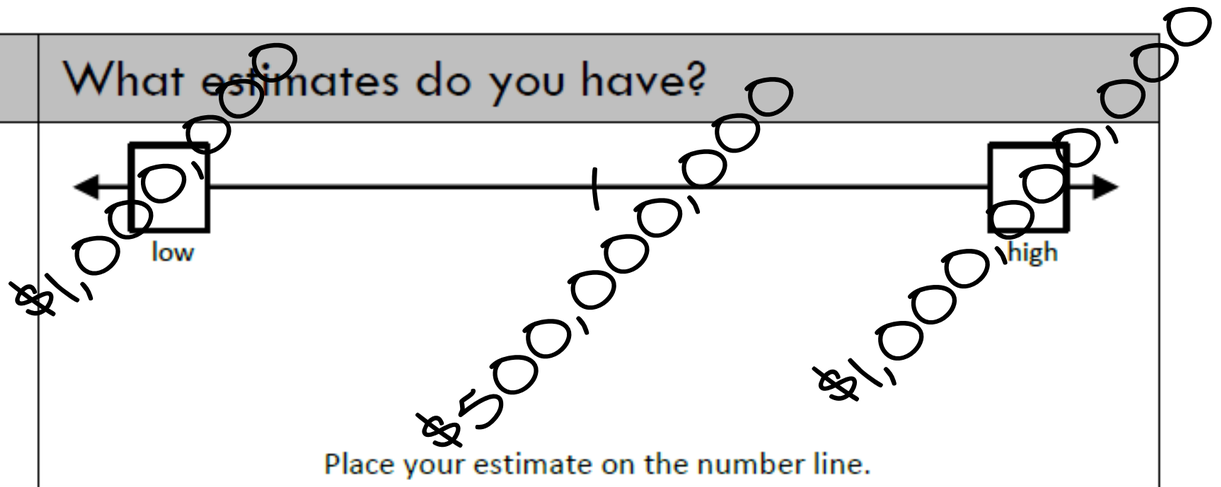
# THINKING TIME

RobertKaplinsky.com

Name: _____ Period: _____ Date: _____

| What problem are you trying to figure out? | What estimates do you have? |
| --- | --- |
| How much money was that? |   Place your estimate on the number line. |
| **What info do you already know about the problem?** | **What info do you need about the problem?** |
| • There is a lot of money.<br>• It is in a pile.<br>• It is in bundles. | • Is it all the same denomination?<br>• ~~How much does one bill weigh?~~<br>• ~~How much does all the money weigh?~~ |
| **What is your conclusion? How did you reach that conclusion?** | |

Name: _____ Period: _____ Date: _____

| What problem are you trying to figure out? | What estimates do you have? |
| --- | --- |
| How much money was that? |  Place your estimate on the number line. |
| **What info do you already know about the problem?** | **What info do you need about the problem?** |
| • There is a lot of money.<br>• It is in a pile.<br>• It is in bundles. | • Is it all the same denomination?<br>• How many rows and columns are there?<br>• How many bills are in one stack? |
| **What is your conclusion? How did you reach that conclusion?** | |

PGR
SIEDO

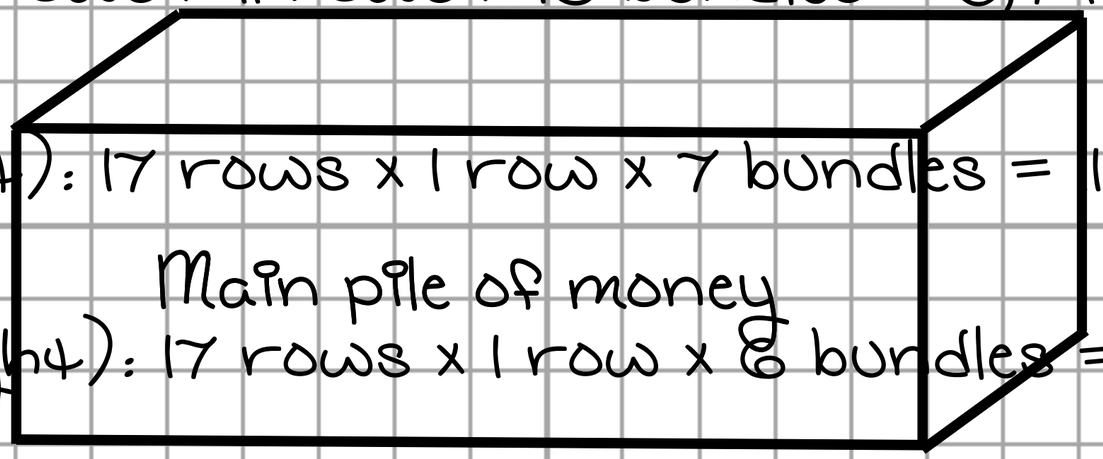
PGR
SIEDO
PGR
SIEDO

Your work

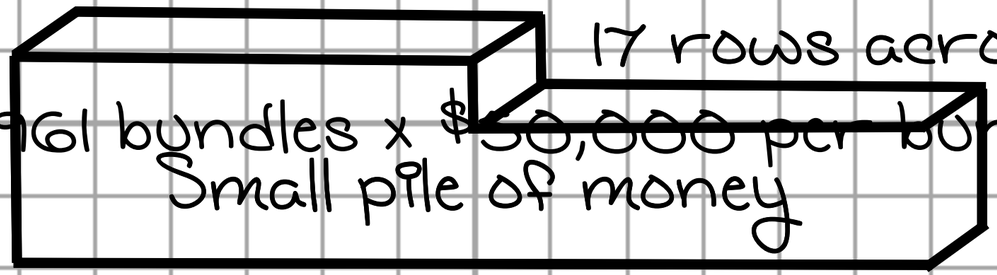
Main pile: 34 rows x 11 rows across x 10 bundles = 3,740 bundles

Small pile (left): 17 rows x 1 row x 7 bundles = 119 bundles

Small pile (right): 17 rows x 1 row x 8 bundles = 136 bundles




Total bundles: 3,740 + 119 + 136 = 3,961 bundles



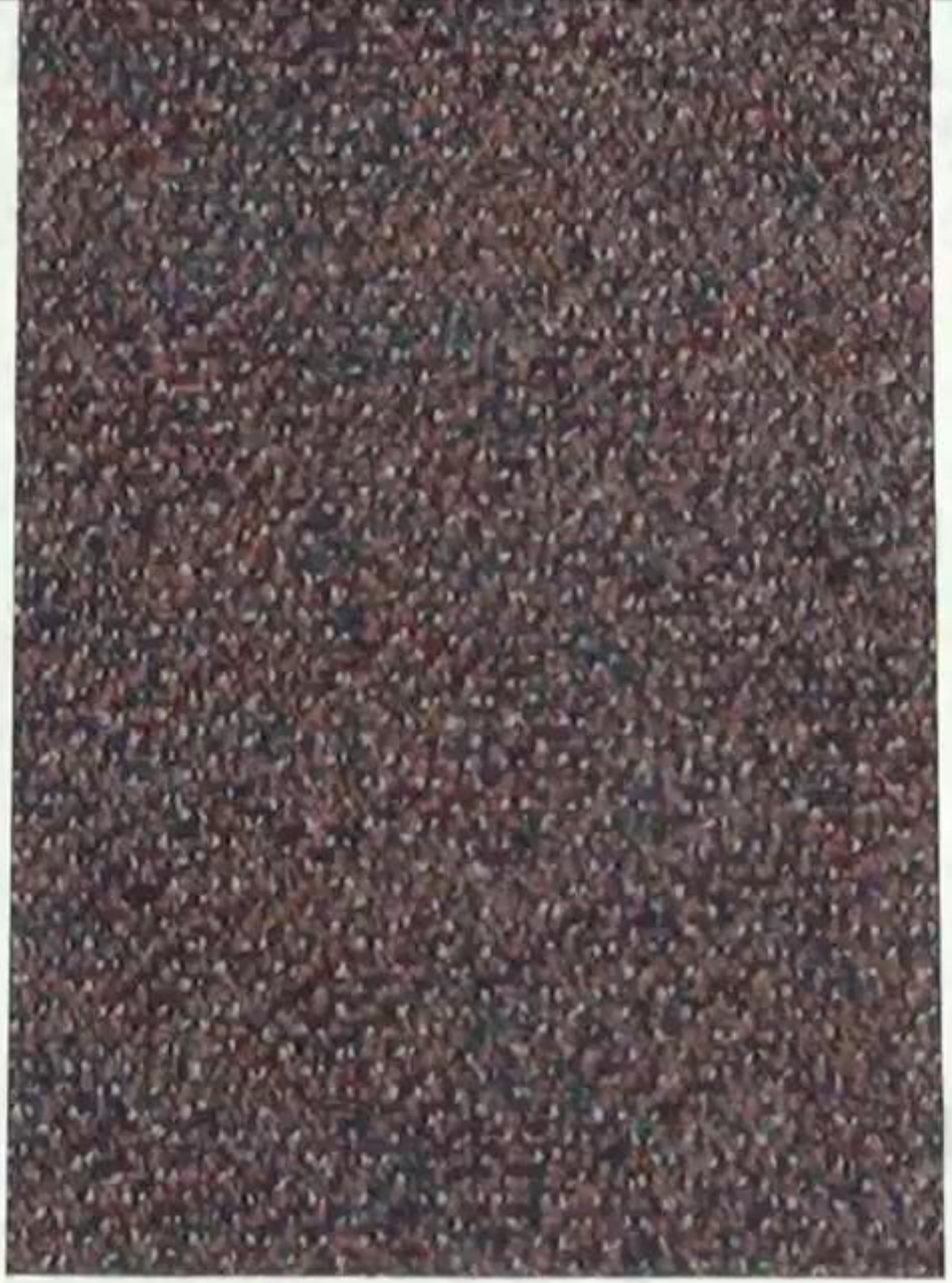

Total money: 3,961 bundles x $50,000 per bundle = $198,050,000

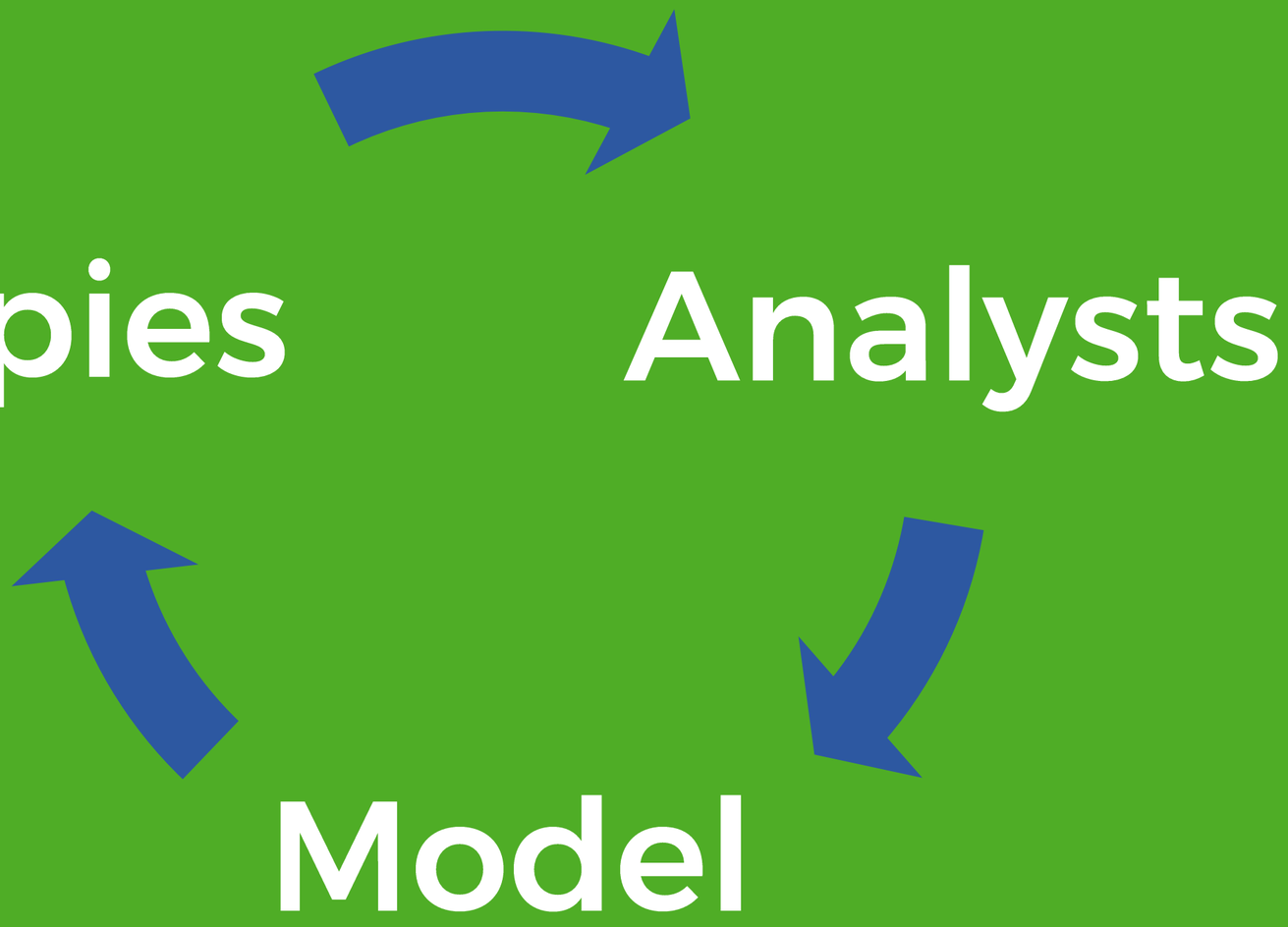
FOX
FOX NEWS

# MODELING EXAMPLES

- [x] MIDDLE SCHOOL
- [ ] HIGH SCHOOL

NON-STAGGERED
STAGGERED

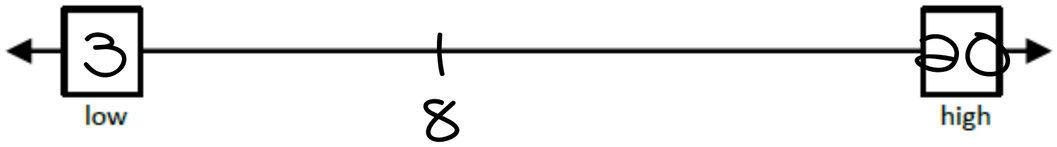



Spies
Analysts
Model

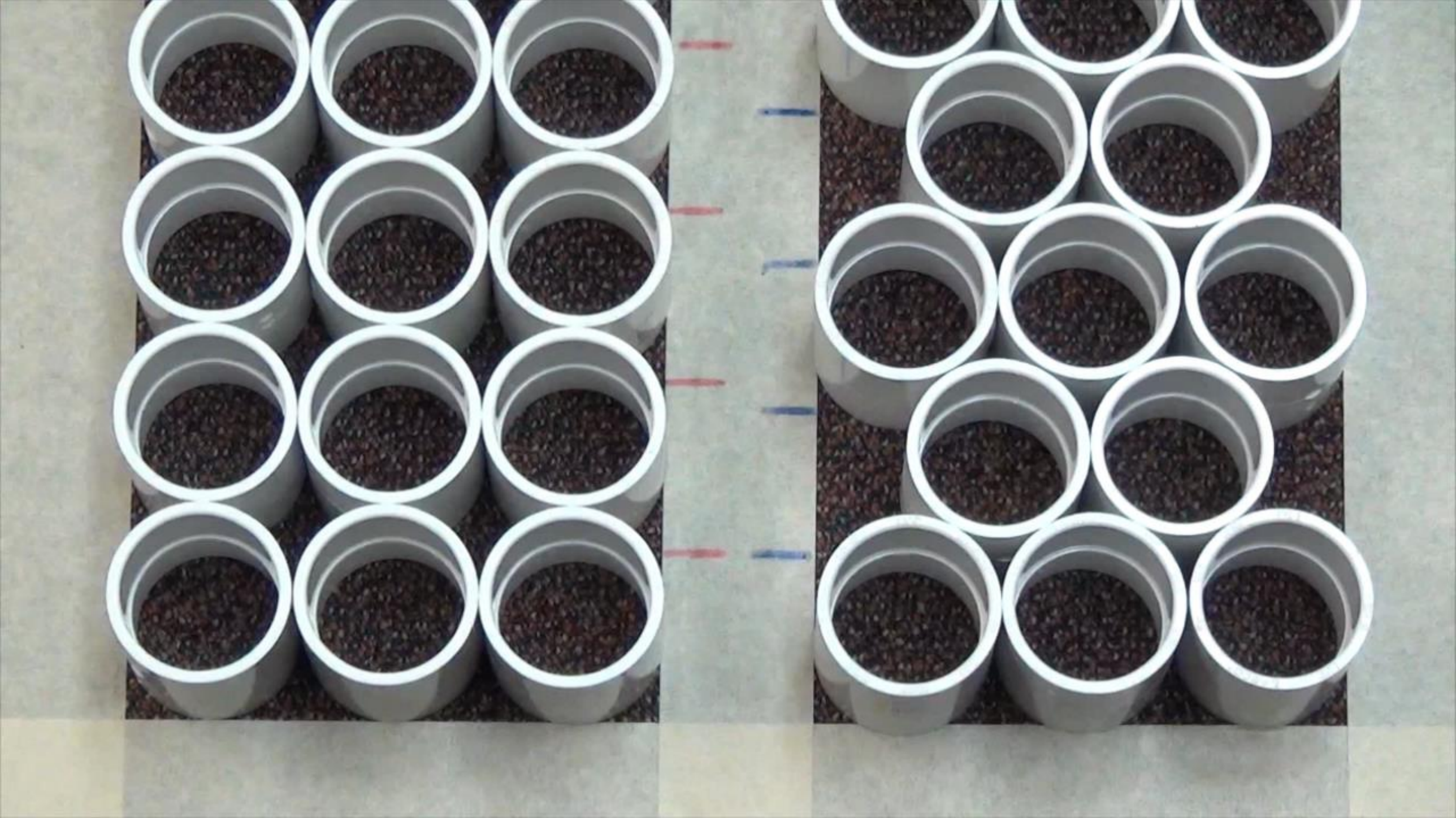
# THINKING TIME

RobertKaplinsky.com

Name: _____ Period: _____ Date: _____

| What problem are you trying to figure out? | What estimates do you have? |
| --- | --- |
| How much shorter are 20 layers of non-staggered pipes? |  <br>(in inches)<br>Place your estimate on the number line. |
| **What info do you already know about the problem?** | **What info do you need about the problem?** |
| • One pile of pipes is staggered.<br>• One pile of pipes is not staggered.<br>• We have to compare 20 layers of each. | • What are the dimensions of a pipe?<br>• What units are we using to measure? |
| **What is your conclusion? How did you reach that conclusion?** | |

6
7

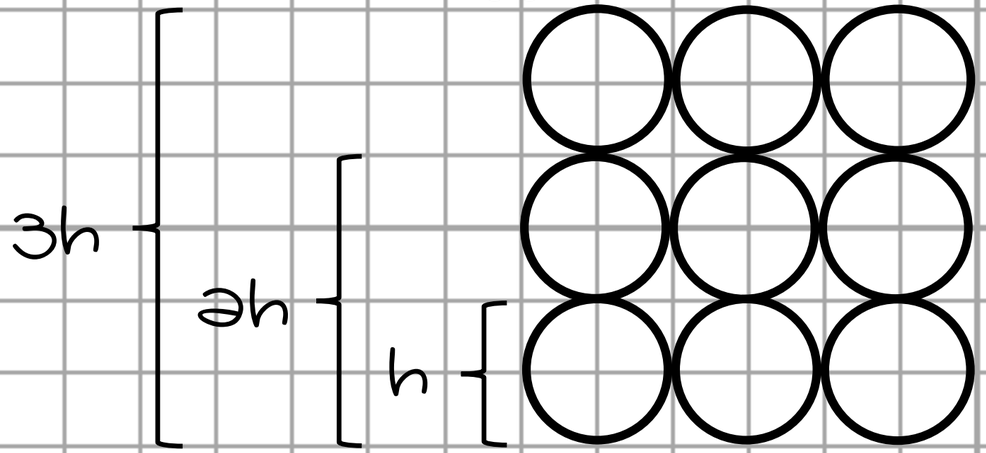


# THINKING TIME

RobertKaplinsky.com

Your work

## Non-staggered pipes




1 pipe = h cm

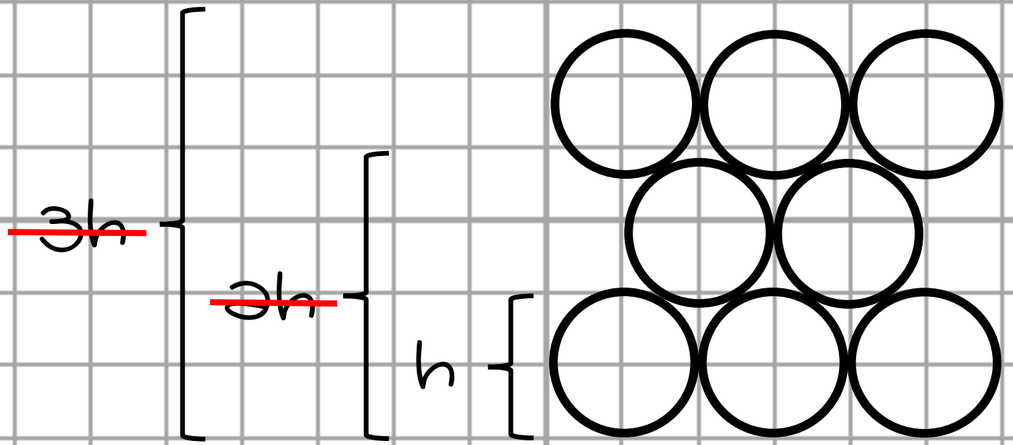
2 pipes = 2h cm

3 pipes = 3h cm

⋮

20 pipes = 20h cm

## Staggered pipes




1 pipe = h cm

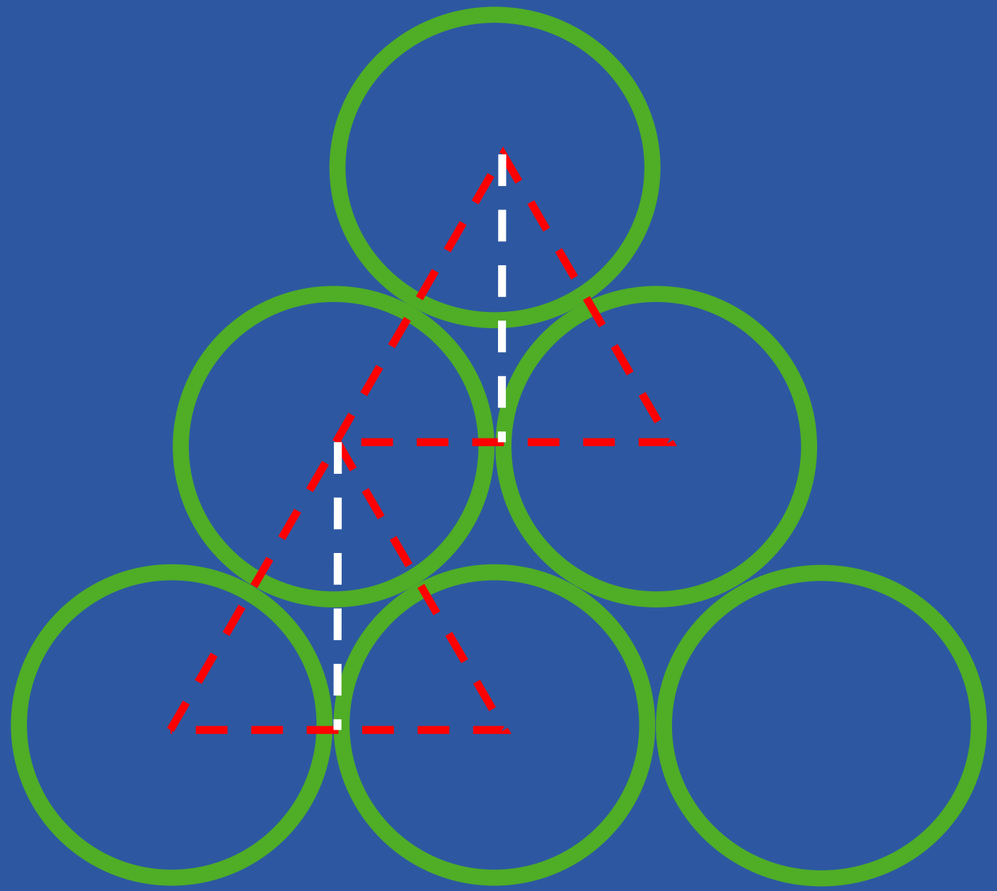
2 pipes = 33 cm

3 pipes = 33 cm

⋮

20 pipes = 33 cm

# STAGGERED PIPES



# MODELING EXAMPLES

- ☑ MIDDLE SCHOOL
- ☑ HIGH SCHOOL

# GOALS

- ☑ HOW DO WE MAKE SENSE OF MATH MODELING?
- ☑ IS IT JUST ANSWERING QUESTIONS?
- ☑ HOW DO YOU PROFIT FROM  MATH MODELING?
- ☑ HOW DO WE HELP OUR STUDENTS IMPROVE?
- ☐ WHERE CAN WE FIND MORE RESOURCES?

# PBL RESOURCES

- Problem-based lesson search engine:
  robertkaplinsky.com/prbl-search-engine
- My lessons (Elementary, Middle, and High School)
  robertkaplinsky.com/lessons
- Dan Meyer (Middle and High School)
  threeacts.mrmeyer.com
- Andrew Stadel (Elementary and Middle School)
  www.estimation180.com/lessons.html
- Graham Fletcher (Elementary and Middle School)
  gfletchy.com/3-act-lessons

Robert Kaplinsky



# Home

## How I Can Help You

### Real World Problems

My workshops help teachers implement problem-based lessons by helping them experience them from both student and teacher perspective, leading to increase students' success with performance tasks and the Common Core State Standards.

### Depth of Knowledge

Problems at higher depth of knowledge levels have the potential to challenge your most talented student yet remain accessible to everyone. I can help teachers develop best practices for implementing them so that students persevere longer towards finding the solution.

## Search

Type and hit enter ...

## Subscribe for Updates

Do you like the ideas you're reading? If so, you'll love having the best ones sent to you via email!

Enter your information below and I'll send you a short email each Tuesday about an idea you can use with your students right away.

If you live in the United States, enter your zip code and I'll use it to let you know about events near you.

First Name

# Lessons

View all | Kinder | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | Alg 1 | Geo | Alg 2

## How Much Money Were Those Pennies?

## How Can We #SaveNelly?

## How Many Chip Bags Will There Be?

## How Can We Make Stronger Passwords?

### Search

Type and hit enter ...

### Subscribe for Updates

Do you like the ideas you're reading? If so, you'll love having the best ones sent to you via email!

Enter your information below and I'll send you a short email each Tuesday about an idea you can use with your students right away.

If you live in the United States, enter your zip code and I'll use it to let you know about events near you.

First Name

# Robert Kaplinsky's Problem-Based Lessons

File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive

| | A | B | C | D | E | F | G | H | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Lesson | Concept / Skill | Standard 1 | Standard 2 | Standard 3 | Standard 4 | Standard 5 | Standard 6 | Stan 7 |
| 2 | How Much Money Were Those Pennies? | Money, Multiplying Decimals, Proportions | 4.MD.2 | 5.NBT.5 | 5.NBT.7 | 7.RP.3 | | | |
| 3 | How Can We #SaveNelly? | Dividing Decimals | 6.NS.3 | | | | | | |
| 4 | How Many Chip Bags Will There Be? | Ratio and Proportions, Population Sampling | 6.RP.3 | 6.RP.3c | 7.RP.2 | 7.RP.3 | 7.SP.1 | 7.SP.2 | |
| 5 | How Can We Make Stronger Passwords? | Permutations, Combinations, Probability, Exponents, Exponential Growth | 7.SP.8 | 8.EE.1 | S-MD.7 | S-CP.5 | S-CP.9 | | |
| 6 | How Many Hot Dogs And Buns Should He Buy? | Least Common Multiple (LCM) | 6.NS.4 | | | | | | |
| 7 | What Does 2000 Calories Look Like? | Unit Rates, Ratios, Solving Equations, and Solving Inequalities | 6.EE.3 | 6.EE.4 | 6.EE.5 | 6.EE.6 | 6.EE.7 | 6.EE.8 | 6.RP.2 |
| 8 | How Much Money Are The Coins Worth? | Decimal Operations and Coin Counting | 2.MD.8 | 5.NBT.7 | 6.NS.3 | | | | |
| 9 | How Many Times Will A Case of Paper Jam? | Interpreting Percentages | 6.RP.3c | 7.RP.3 | | | | | |
| 10 | How Many Soda Combinations Are There On A Coke Freestyle? | Counting, Composing, and Decomposing Numbers | K.CC.5 | K.CC.6 | K.OA.1 | K.OA.2 | K.OA.3 | K.OA.4 | K.NBT |
| 11 | What Should The Freeway Sign Show? | Fractions on Number Lines, Converting Units, Decimal and Fraction Operations | 3.NF.1 | 3.NF.2 | 3.NF.2a | 3.NF.2b | 3.NF.3 | 3.NF.3a | 4.MD. |
| 12 | How Fast Was The Fastest Motorcycle Speeding Ticket Ever? | Converting Units and Unit Rates | 5.MD.1 | 6.RP.3d | 7.RP.1 | N.Q.1 | | | |
| 13 | How Much Did Patrick Peterson Lose By Not Cashing His Check? | Compound and/or Simple Interest | 7.RP.3 | N-RN.2 | A-SSE.1 | A-SSE.3c | A-SSE.4 | A-REI.11 | F-IF.4 |
| 14 | How Many Biscuits Can You Make? | Dividing Fractions and Mixed Numbers | 5.NF.7 | 5.NF.7a | 5.NF.7b | 5.NF.7c | 6.NS.1 | | |
| 15 | How Much Bigger Should They Make Zoolander's School? | Scale and Proportions | 5.NF.5A | 7.RP.2 | 7.G.1 | | | | |
| 16 | Where Is The Freeway Sign Located? | Identifying Fractions on a Number Line | 3.NF.1 | 3.NF.2 | 3.NF.2a | 3.NF.2b | 3.NF.3 | 3.NF.3a | 3.NF.3 |
| 17 | How Far Apart Are Exits On A Ring Road? | Arc length measures | G-C.5 | | | | | | |
| 18 | How Much Is One Third Of A Cup Of Butter? | Identifying Fractions on a Number Line | 3.NF.1 | 3.NF.2 | 3.NF.2a | 3.NF.2b | 3.NF.3 | 3.NF.3a | 3.NF.3 |
| 19 | How Do Skytypers Write Messages? | Transformations (Rotations, Reflections, Dilations, and Translations) | 8.G.1 | 8.G.2 | 8.G.3 | 8.G.4 | G-CO.2 | G-CO.3 | G-CO |
| 20 | How Big Is The Bermuda Triangle? | Coordinate Geometry: Area of Triangle | G-GPE.7 | | | | | | |
| 21 | What Fraction Of Children Are In The Right Car Seat? | Representing and Comparing Fractions | 3.NF.1 | 3.NF.2 | 3.NF.3 | 4.NF.1 | 4.NF.2 | | |
| 22 | How Much Did The Temperature Drop? | Absolute Value | 6.NS.7c | 7.NS.1c | | | | | |
| 23 | How Much Shorter Are Staggered Pipe Stacks? | Circles, Pythagorean Theorem, trigonometric ratios, and linear functions | 8.G.7 | A-CED.1 | A-CED.3 | A-CED.4 | A-SSE.1a | A-SSE.1b | A-SSE |
| 24 | How Do You Write A Check To Pay For Something? | Expanded Form | 2.NBT.3 | 4.NBT.2 | 5.NBT.3a | | | | |
| 25 | How Can We Correct The Scarecrow? | Pythagorean Theorem | 8.G.6 | G-SRT.4 | | | | | |
| 26 | How Much Does A 100×100 In-N-Out Cheeseburger Cost? | Building and Interpretting Linear Functions | 8.F.1 | 8.F.3 | 8.F.4 | 8.F.5 | F-IF.4 | F-IF.5 | F-IF.6 |
| 27 | How Can We Water All Of The Grass? | Circles, Pythagorean Theorem, trigonometric ratios | 7.G.4 | 8.G.7 | G-SRT.8 | G-MG.1 | G-MG.3 | | |
| 28 | How Much Money IS That?! | Volume of rectangular prism | 5.MD.3 | 5.MD.4 | 5.MD.5 | 5.MD.5b | 5.MD.5c | 6.G.2 | 7.G.6 |
| 29 | How Much Money Should Dr. Evil Demand? | Exponential Growth | N-RN.2 | A-SSE.1 | A-SSE.3c | A-SSE.4 | A-REI.11 | F-IF.4 | F-IF.7 |
| 30 | How Tall Is Mini-Me? | Scale and Dividing Decimals | 5.NF.5 | 5.NF.5a | 5.NF.5b | 6.NS.3 | | | |
| 31 | How Did They Make Ms. Pac-Man? | Transformations (Rotations, Reflections, and Translations) | 8.G.1 | 8.G.2 | 8.G.3 | 8.G.4 | G-SRT.2 | G-CO.4 | G-CO |
| 32 | Which Ticket Option Is The Best Deal? | Unit Rates and Ratios | 6.RP.2 | 6.RP.3 | 6.RP.3a | 6.RP.3b | | | |
| 33 | How Far Apart Are The Freeway Exits? | Fractions on a Number Line and Subtracting Fractions | 3.NF.2 | 3.NF.2b | 4.NF.2 | 4.NF.3a | 4.NF.3c | 4.NF.3d | 5.NF.1 |
| 34 | Do We Have Enough Paint? | Area | 3.MD.5 | 3.MD.6 | 3.MD.7 | | | | |

Sheet1

# GOALS

- ☑ HOW DO WE MAKE SENSE OF MATH MODELING?
- ☑ IS IT JUST ANSWERING QUESTIONS?
- ☑ HOW DO YOU PROFIT FROM  MATH MODELING?
- ☑ HOW DO WE HELP OUR STUDENTS IMPROVE?
- ☑ WHERE CAN WE FIND MORE RESOURCES?

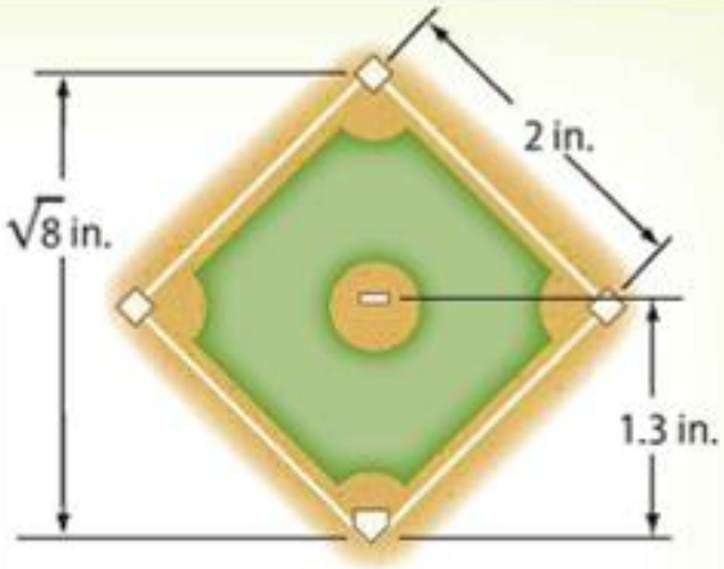
# Real-World Link

**Common Core State Standards**

**Content Standards**
8.NS.1, 8.NS.2, 8.EE.2

**Mathematical Practices**
1, 3, 4, 6

**Sports** Major League baseball has rules for the dimensions of the baseball diamond. A model of the diamond is shown.




**1.** On the model, the distance from the pitching mound to home plate is 1.3 inches. Is 1.3 a rational number? Explain.

**2.** On the model, the distance from first base to second base is 2 inches. Is 2 a rational number? Explain.

**3.** The distance from home plate to second base is $\sqrt{8}$ inches. Using a calculator, find $\sqrt{8}$. Does it appear to terminate or repeat?

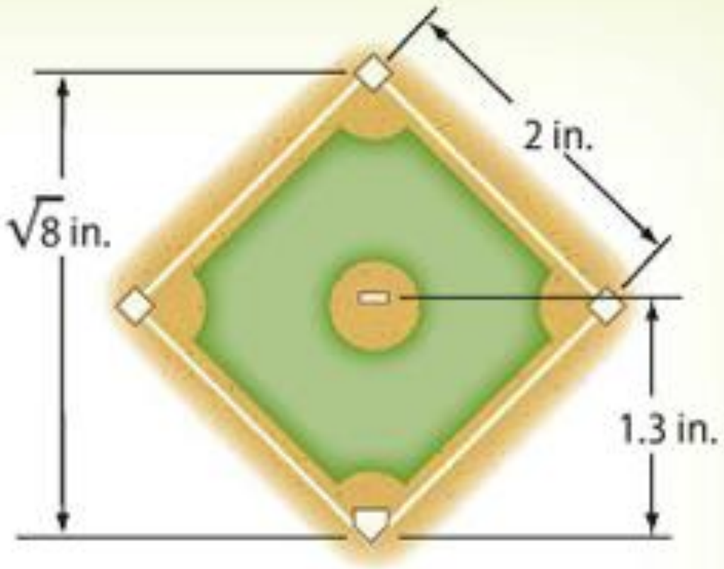
# Real-World Link

**Common Core State Standards**

**Content Standards**
8.NS.1, 8.NS.2, 8.EE.2

**Mathematical Practices**
1, 3, 4, 6

**Sports** Major League baseball has rules for the dimensions of the baseball diamond. A model of the diamond is shown.




1. On the model, the distance from the pitching mound to home plate is 1.3 inches. Is 1.3 a rational number? Explain.

2. On the model, the distance from first base to second base is 2 inches. Is 2 a rational number? Explain.

3. The distance from home plate to second base is $\sqrt{8}$ inches. Using a calculator, find $\sqrt{8}$. Does it appear to terminate or repeat?

# Scary & Dangerous

NETFLIX
2009
NETFLIX
DATE: 09·21·09
PAY TO THE ORDER OF: BellKor's Pragmatic Chaos
$ 1,000,000 00
AMOUNT: ONE MILLION 00/100
FOR The Netflix Prize
Reed Hastings

# MATH MODELING CAN MAKE YOU FILTHY RICH


## ROBERT KAPLINSKY

robert@robertkaplinsky.com

robertkaplinsky.com/lausd18

@robertkaplinsky