California H-2A visas analysis

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The Los Angeles Times conducted an analysis of temporary visas granted to foreign agricultural workers by the United States Department of Labor via its H-2A program.

The results were reported in a May 25, 2017, Los Angeles Times story titled "Trump promised a 'big beautiful door' in his border wall. California farmers are ready and waiting" (http://www.latimes.com/projects/la-fi-farm-labor-guestworkers/).

Here are the key findings of the data analysis, which is documented below:

- The total number of certified H2A visas is going up nationwide
- California's total topped 11,000 last year, a fivefold increase from 2011
- If this year's hiring pace holds, that number will soar even higher
- Counties on the Central Coast, from Ventura up to Santa Cruz, are driving the growth
- Strawberries and lettuce crops have accounted for most of the new workers
- The Santa Maria Valley, straddling San Louis Obispo and Santa Barbara counties, leapt from six sheepherders in 2012 to more than 2,000 guest farm workers last year
- Strawberry workers account for most of the growth in that area

How we did it

Import Python analysis tools

In [1]:
```
import os
import pandas as pd
import geopandas as gp
from datetime import date
from shapely.geometry import Point
```

In [2]:
```
import warnings
warnings.filterwarnings("ignore")
```

In [3]:
```
pd.options.display.max_columns = None
```

In [4]:
```
%matplotlib inline
```

In [5]:
```
input_dir = os.path.join(os.getcwd(), 'input')
output_dir = os.path.join(os.getcwd(), 'output')
```

Prepare the data for analysis

Download the source data files from the U.S. Department of Labor's Office of Foreign Labor Certification (https://www.foreignlaborcert.doleta.gov/performancedata.cfm).

In [40]:
```
%%capture
%run 01_download.ipynb
```

Prepare them for analysis by carefully combining annual lists, winnowing out duplicate entries and limiting the result to approved applications.

In [41]:
```
%%capture
%run 02_transform.ipynb
```

Map work site locations

In [42]:
```
%%capture
run 03_geocode.ipynb
```

Finding: The total number of certified H2A visas is going up nationwide

Read in the transformed file for analysis

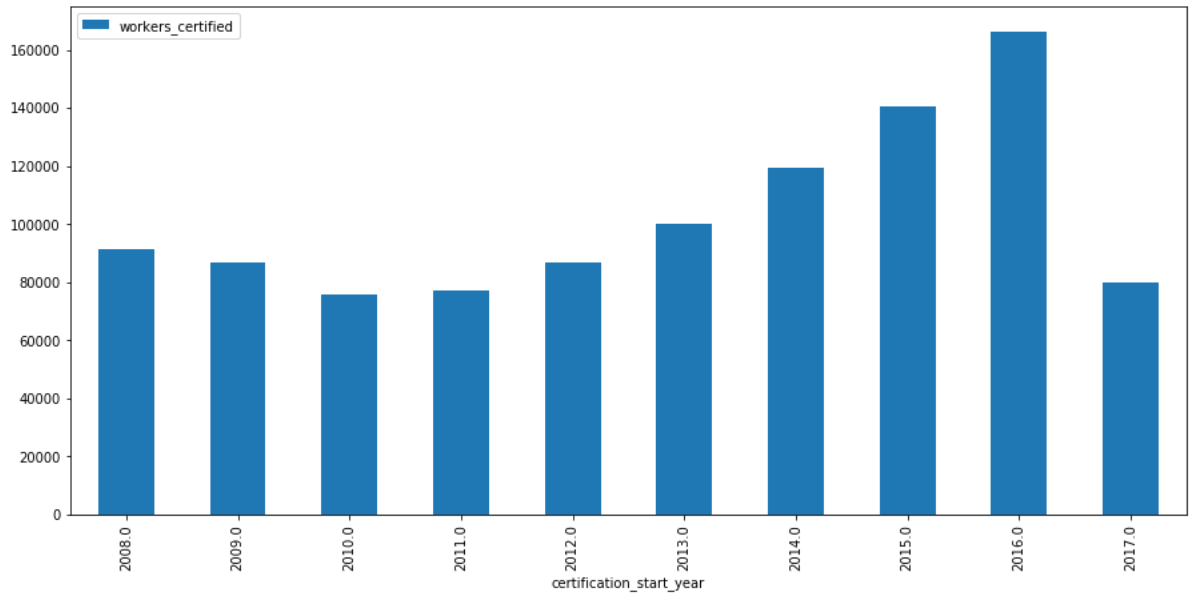
In [6]:
```
df = pd.read_csv(
    os.path.join(output_dir, "transformed_master_cases.csv"),
    index_col="latimes_id",
)
```

Group by calendar year and sum the total number of certified workers

In [7]:
```
annual_usa = df.groupby("certification_start_year").agg(dict(workers_certified
="sum"))
```

In [8]:
```
annual_usa.plot.bar(figsize=(15, 7))
```

Out[8]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff472aa0f50>
```



In [9]:
```
annual_usa
```

Out[9]:

certification_start_year	workers_certified
2008.0	91324
2009.0	86604
2010.0	75617
2011.0	77221
2012.0	86725
2013.0	100360
2014.0	119240
2015.0	140701
2016.0	166457
2017.0	79893

Finding: California's total topped 11,000 last year, a fivefold increase from 2011

Group the applications by state and year

In [10]:
```
state_totals = df.groupby([
    'state',
    'certification_start_year']
).agg(dict(workers_certified="sum"))
```

Create a crosstab for a graphic and comparison

In [11]:
```
state_crosstab = state_totals.unstack(1).fillna(0)
```

Output it for a graphic

In [12]:
```
state_crosstab.to_csv("./output/state_crosstab.csv")
```

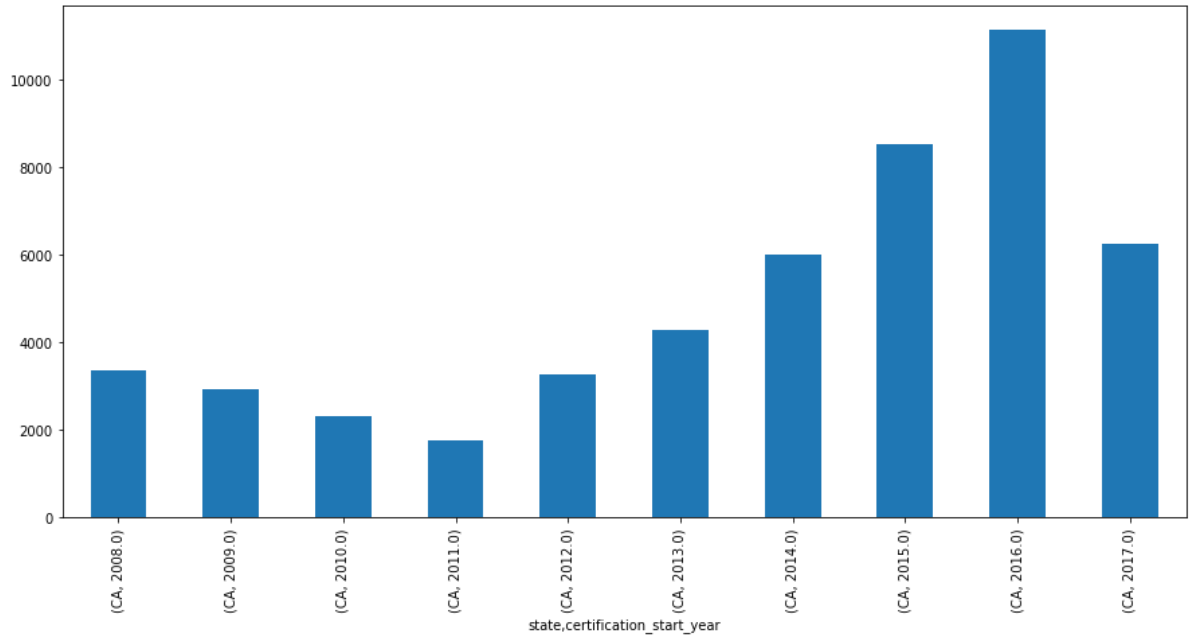
Filter down to just California's totals

In [13]:
```
ca_totals = state_totals[state_totals.index.get_level_values(0) == 'CA']
```

Ouput the annual totals

In [14]:
```
ca_totals.workers_certified.plot.bar(figsize=(15, 7))
```

Out[14]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff47344a0d0>
```



In [15]:
```
ca_totals
```

Out[15]:

		workers_certified
state	**certification_start_year**	
CA	**2008.0**	3353
	2009.0	2941
	2010.0	2298
	2011.0	1774
	2012.0	3249
	2013.0	4291
	2014.0	6011
	2015.0	8529
	2016.0	11131
	2017.0	6230

Trim down to the last five years of data and calculate California's percentage change

In [16]:
```
ca_last_five = ca_totals[
    (ca_totals.index.get_level_values(1) > 2010) &
    (ca_totals.index.get_level_values(1) < 2017)
].reset_index()
```

In [17]:
```
ca_pct_change = ca_last_five[[
  'certification_start_year',
  'workers_certified'
]].set_index('certification_start_year').pct_change(
    len(ca_last_five)-1
)
```

In [18]:
```
print "Percent change: %s%%" % round(ca_pct_change.at[2016.0, 'workers_certified']*100, 2)
```

```
Percent change: 527.45%
```

Output for a graphic

In [19]:
```
ca_totals.reset_index()[['certification_start_year', 'workers_certified']].to_csv(
    "./output/california-totals-graphics.csv",
    index=False
)
```

Finding: If this year's hiring pace holds, that number will soar even higher

Convert the start date column to a datetime object

In [20]:
```
df.certification_start_date = pd.to_datetime(df.certification_start_date)
```

Pull out the first four months of this year versus last year

In [21]:
```
first_four_16 = df[
    (df.state == 'CA') &
    (df.certification_start_date >= date(2016, 1, 1)) &
    (df.certification_start_date < date(2016, 5, 1))
]
```

In [22]:
```
first_four_17 = df[
    (df.state == 'CA') &
    (df.certification_start_date >= date(2017, 1, 1)) &
    (df.certification_start_date < date(2017, 5, 1))
]
```

Compare the total hires in that period

In [23]:
```
first_four_16.workers_certified.sum()
```

Out[23]: 4838

In [24]:
```
first_four_17.workers_certified.sum()
```

Out[24]: 6115

Finding: Counties on the Central Coast, from Ventura up to Santa Cruz, are driving the growth

Read in all "sub" cases rather than the master cases. This allows for the farms where workers are actually employed to be mapped, rather than the the "master cases" of middlemen who sometimes file the "master" applications.

In [25]:
```
combined_df = pd.read_csv(os.path.join(output_dir, "geocoded_all_cases.csv"))
```

Convert to a geodataframe.

In [26]:
```
def create_point(row):
    if row.lng and row.lat:
        return Point(row.lng, row.lat)
    return ''
```

In [27]:
```
combined_df['geometry'] = combined_df.apply(create_point, axis=1)
```

In [28]:
```
gdf = gp.GeoDataFrame(combined_df)
```

In [29]:
```
gdf.crs = {'init' :'epsg:4269'}
```

Exclude cases that could not be mapped.

In [34]:
```
valid_gdf = gdf[~gdf.lat.isnull()]
```

Spatial join with county polygons

In [35]:
```
counties = gp.read_file(os.path.join(input_dir, "cb_2016_us_county_5m.shp"))
```

In [36]:
```
gdf_with_county = gp.sjoin(counties, valid_gdf, how="inner")
```

Filter to California

In [37]:
```
ca_gdf = gdf_with_county[gdf_with_county.STATEFP == '06']
```

Create a crosstab of the total number of workers by year in all California counties

In [38]:
```
county_crosstab = ca_gdf.groupby([
    'NAME',
    'certification_start_year'
]).net_workers.sum().reset_index().set_index([
    "NAME",
    "certification_start_year"
]).unstack(1).fillna(0)
```

Strip all the pandas chrome off the crosstab

In [39]:
```
county_crosstab = county_crosstab.reset_index()
county_crosstab.columns = county_crosstab.columns.droplevel(0)
county_crosstab = county_crosstab.rename_axis(None, axis=1)
county_crosstab = county_crosstab.set_index("")
```

Calculate the change in each county

In [40]:
```
county_crosstab['change_11to16'] = county_crosstab.apply(
    lambda x: x[2016.0] - x[2011.0],
    axis=1
)
```

Rank them by their change

In [41]:
```
county_crosstab.sort_values("change_11to16", ascending=False).head(10)
```

Out[41]:

	2008.0	2009.0	2010.0	2011.0	2012.0	2013.0	2014.0	2015.0	2016.0	2017.0	change
Monterey	396.0	806.0	80.0	0.0	204.0	266.0	366.0	1023.0	2318.0	1947.0	
Santa Barbara	0.0	2.0	0.0	0.0	0.0	158.0	909.0	1313.0	1450.0	1201.0	
Ventura	37.0	1.0	0.0	0.0	39.0	255.0	354.0	849.0	991.0	806.0	
Santa Cruz	102.0	179.0	120.0	139.0	3.0	0.0	267.0	916.0	882.0	273.0	
San Luis Obispo	11.0	14.0	7.0	12.0	6.0	52.0	83.0	286.0	639.0	285.0	
San Diego	646.0	526.0	625.0	1.0	485.0	646.0	836.0	660.0	569.0	186.0	
Imperial	566.0	374.0	396.0	556.0	663.0	851.0	985.0	868.0	1069.0	233.0	
Santa Clara	1.0	5.0	0.0	0.0	0.0	0.0	0.0	120.0	310.0	12.0	
Siskiyou	730.0	0.0	0.0	495.0	565.0	631.0	769.0	772.0	803.0	146.0	
Fresno	80.0	59.0	17.0	32.0	36.0	5.0	35.0	208.0	286.0	34.0	

Output that for a graphic

In [42]:
```
county_crosstab.to_csv(os.path.join(output_dir, "county-crosstab.csv"), encoding="utf-8")
```

Total up the workers by city for a map

In [43]:
```
ca_location_totals = ca_gdf.groupby([
    "certification_start_year",
    "geocoder_address",
    "lat",
    'lng',
]).net_workers.sum().reset_index()
```

In [44]:
```
ca_location_totals['certification_start_year'] = ca_location_totals.certification_start_year.astype(int)
```

In [45]:
```
ca_location_totals['net_workers'] = ca_location_totals.net_workers.astype(int)
```

In [46]:
```
ca_location_totals.columns = [
    'year',
    'address',
    'lat',
    'lng',
    'workers'
]
```

Output that for a graphic

In [47]:
```
ca_location_totals.to_csv(os.path.join(output_dir, "ca_totals_by_location.csv"
), index=False)
```

Finding: Strawberries and lettuce crops have accounted for most of the new workers

Regroup subcases in the state by our cleaned up version of the crop column

In [48]:
```
ca_crops = ca_gdf.groupby([
    "certification_start_year",
    "latimes_crop"
]).net_workers.sum().reset_index().sort_values("net_workers", ascending=False)
```

Create a crosstab by year

In [49]:
```
crops_crosstab = ca_crops.set_index([
    "certification_start_year",
    "latimes_crop"
]).unstack(0).fillna(0)
```

Again, strip the pandas chrome from the crosstab

In [50]:
```
crops_crosstab = crops_crosstab.reset_index()
crops_crosstab.columns = crops_crosstab.columns.droplevel(0)
crops_crosstab = crops_crosstab.rename_axis(None, axis=1)
crops_crosstab = crops_crosstab.set_index("")
```

Calculate the change over the past five years

In [51]:
```
crops_crosstab['change_11to16'] = crops_crosstab.apply(
    lambda x: x[2016.0] - x[2011.0],
    axis=1
)
```

Rank the crops

In [52]:
```
crops_crosstab.sort_values("change_11to16", ascending=False).head(10)
```

Out[52]:

	2010.0	2011.0	2012.0	2014.0	2015.0	2016.0	2017.0	change_11to16
Strawberries	0.0	830.0	660.0	0.0	953.0	3695.0	1620.0	2865.0
Lettuce	0.0	532.0	45.0	0.0	1210.0	2052.0	2201.0	1520.0
Broccoli	0.0	0.0	0.0	0.0	0.0	748.0	12.0	748.0
Raspberries	0.0	0.0	0.0	0.0	0.0	531.0	0.0	531.0
Tomatoes	0.0	0.0	350.0	0.0	49.0	475.0	80.0	475.0
Onions	0.0	0.0	0.0	0.0	0.0	380.0	222.0	380.0
Celery	0.0	0.0	0.0	0.0	220.0	364.0	61.0	364.0
Berries	0.0	0.0	0.0	0.0	60.0	341.0	310.0	341.0
Sheep	8.0	370.0	260.0	204.0	723.0	662.0	148.0	292.0
Grapes	0.0	30.0	59.0	0.0	34.0	246.0	511.0	216.0

Ouput for a graphic

In [53]:
```
crops_crosstab.to_csv(os.path.join(output_dir, "crops-crosstab.csv"))
```

Finding: The Santa Maria Valley, straddling San Louis Obispo and Santa Barbara counties, leapt from six sheepherders in 2012 to more than 2,000 guest farm workers last year

Filter down to subcases in those two counties

In [54]:
```
smvalley = gdf_with_county[gdf_with_county.NAME.isin(['Santa Barbara', 'San Lu
is Obispo'])]
```

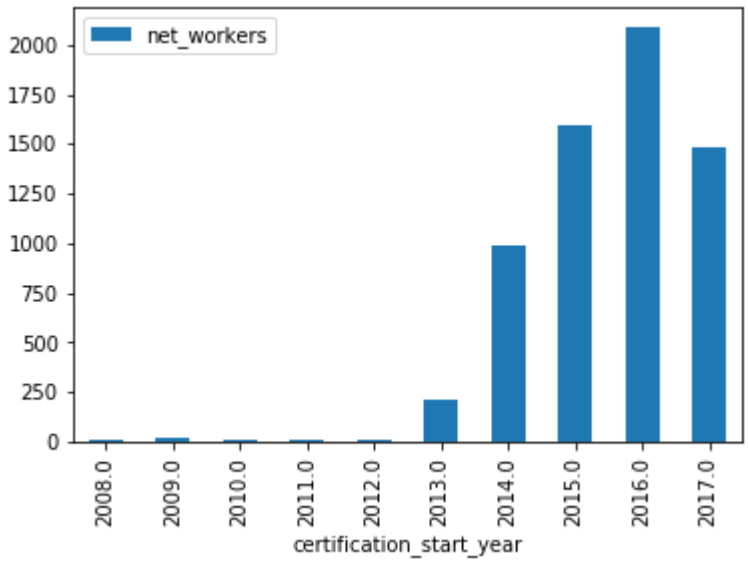
Count the total number of workers there by year

In [55]:
```
smvalley_crosstab = smvalley.groupby([
    'certification_start_year'
]).net_workers.sum().reset_index().set_index("certification_start_year")
```

Ouput the totals

In [56]:
```
smvalley_crosstab.plot.bar()
```

Out[56]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff467824e10>
```



In [57]:
```
smvalley_crosstab
```

Out[57]:

certification_start_year	net_workers
2008.0	11.0
2009.0	16.0
2010.0	7.0
2011.0	12.0
2012.0	6.0
2013.0	210.0
2014.0	992.0
2015.0	1599.0
2016.0	2089.0
2017.0	1486.0

Look at the crop for those 2012 workers

In [58]:
```
smvalley[smvalley.certification_start_year == 2012][[
    'case_number',
    'employer',
    'city',
    'job_title',
    'crop',
    'net_workers'
]]
```

Out[58]:

	case_number	employer	city	job_title	crop	net_workers
735	C-11304-30370	ST. MARTIN JAUREGUY	PASO ROBLES	FARMWORKERS, FARM AND RANCH ANIMALS	Sheepherder	1.0
735	C-11361-31115	ST. MARTIN JAUREGUY	PASO ROBLES	SHEEPHERDER	Sheepherder	2.0
735	C-12033-32422	JEAN B JAUREGUY	PASO ROBLES	SHEEPHERDER	Sheepherder	1.0
735	C-12033-32422	ST. MARTIN JAUREGUY	PASO ROBLES	SHEEPHERDER	Sheepherder	1.0
735	C-12193-35263	JEAN B. JAUREGUY #01568	PASO ROBLES	FARMWORKERS, FARM AND RANCH ANIMALS	Sheepherder	1.0

Finding: Strawberry workers account for most of the growth in that area

In [59]:
```
smvalley_crops = smvalley[smvalley.certification_start_year == 2016].groupby([
    'latimes_crop'
]).net_workers.sum().reset_index().set_index("latimes_crop")
```

In [60]:
```
smvalley_crops.sort_values("net_workers", ascending=False).head(10)
```

Out[60]:

latimes_crop	net_workers
Strawberries	1075.0
Lettuce	324.0
Blackberries	133.0
Celery	95.0
Other	75.0
Zucchini	73.0
Broccoli	53.0
Peppers	45.0
Squash	39.0
Bok Choy	37.0