A Ravensteinesque "Currents of Migration" Map for California

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Ernest George Ravenstein

Born 30 December 1834, Frankfurt, Germany.

Died 13 March 1913 , at age 79, Hofheim, Germany.

1852 Traveled to London to work with Petermann.

Worked at the Royal Geographical Society in London.

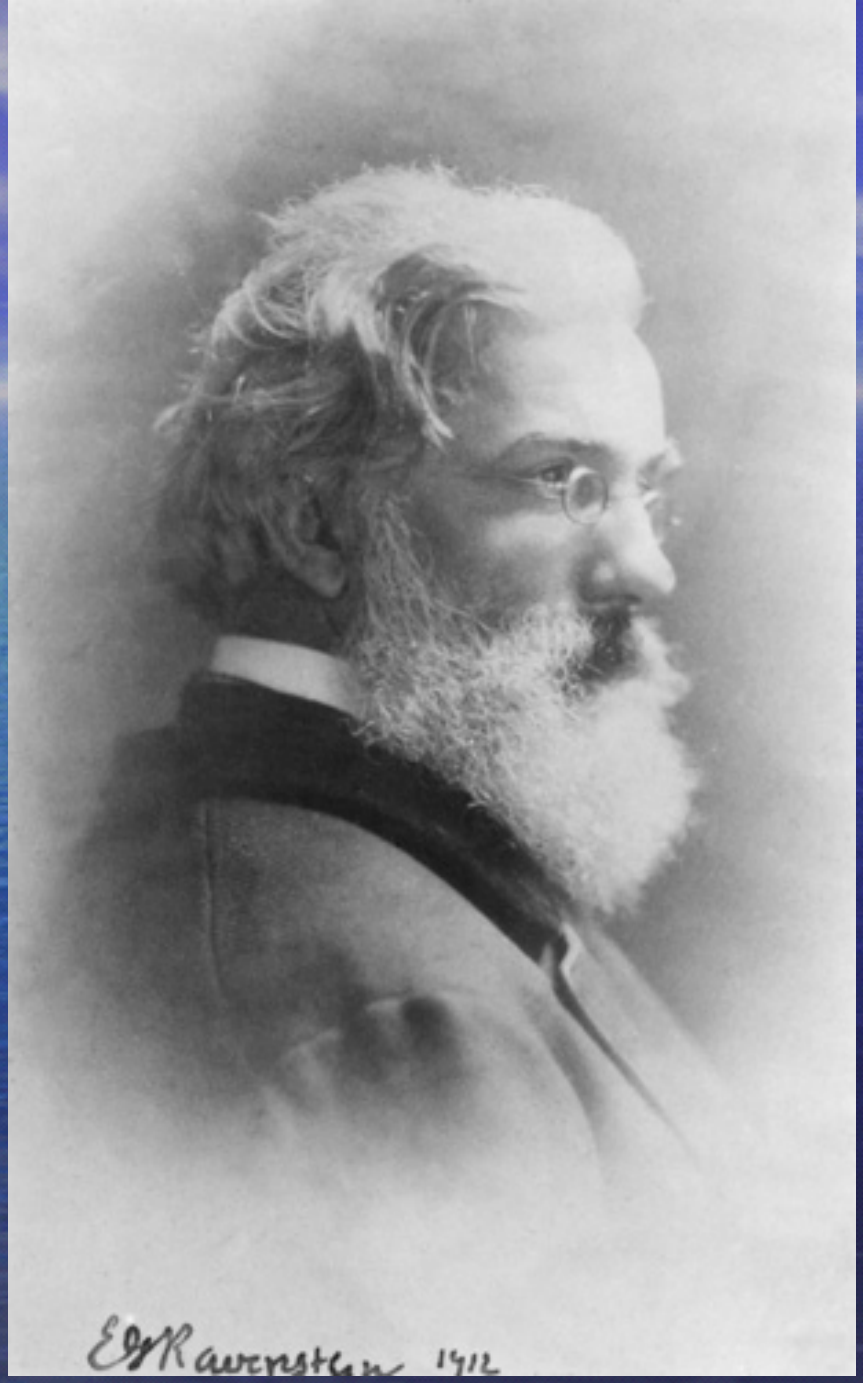
Received the first Gold Medal of that society.

Noted for cartographic work on maps of Africa.

President, Geographical Section of the British Association.

Published a facsimile of Martin Beheim's 1492 globe.

Circa 1885 he wrote three famous papers on Migration.



Courtesy of the Royal Geographical Society

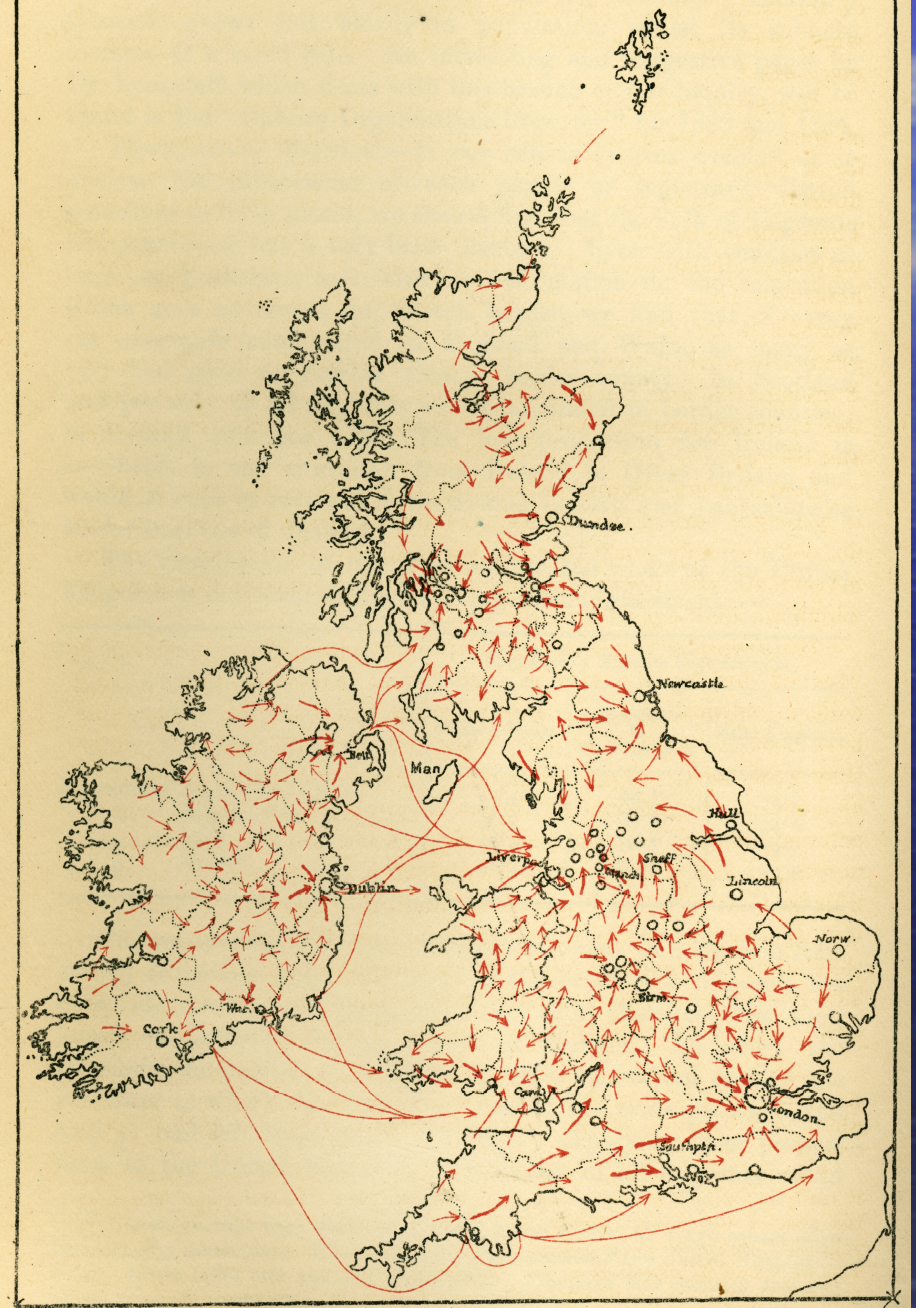
In 1885 he published a map in the Statistical Society Journal

It accompanied his paper on "The Laws of Migration" but was not mentioned in the text.

I have long admired this map but there is no description of how it was prepared.

I have now attempted to produce a similar map for the counties of California

CURRENTS OF MIGRATION.



To illustrate features of the map I enlarge some portions

County boundaries are shown pecked.

Migration is illustrated using red arrows.

They show migration from county to county.

Some cites are named and shown as circles.

Magnitude is occasionally suggested.

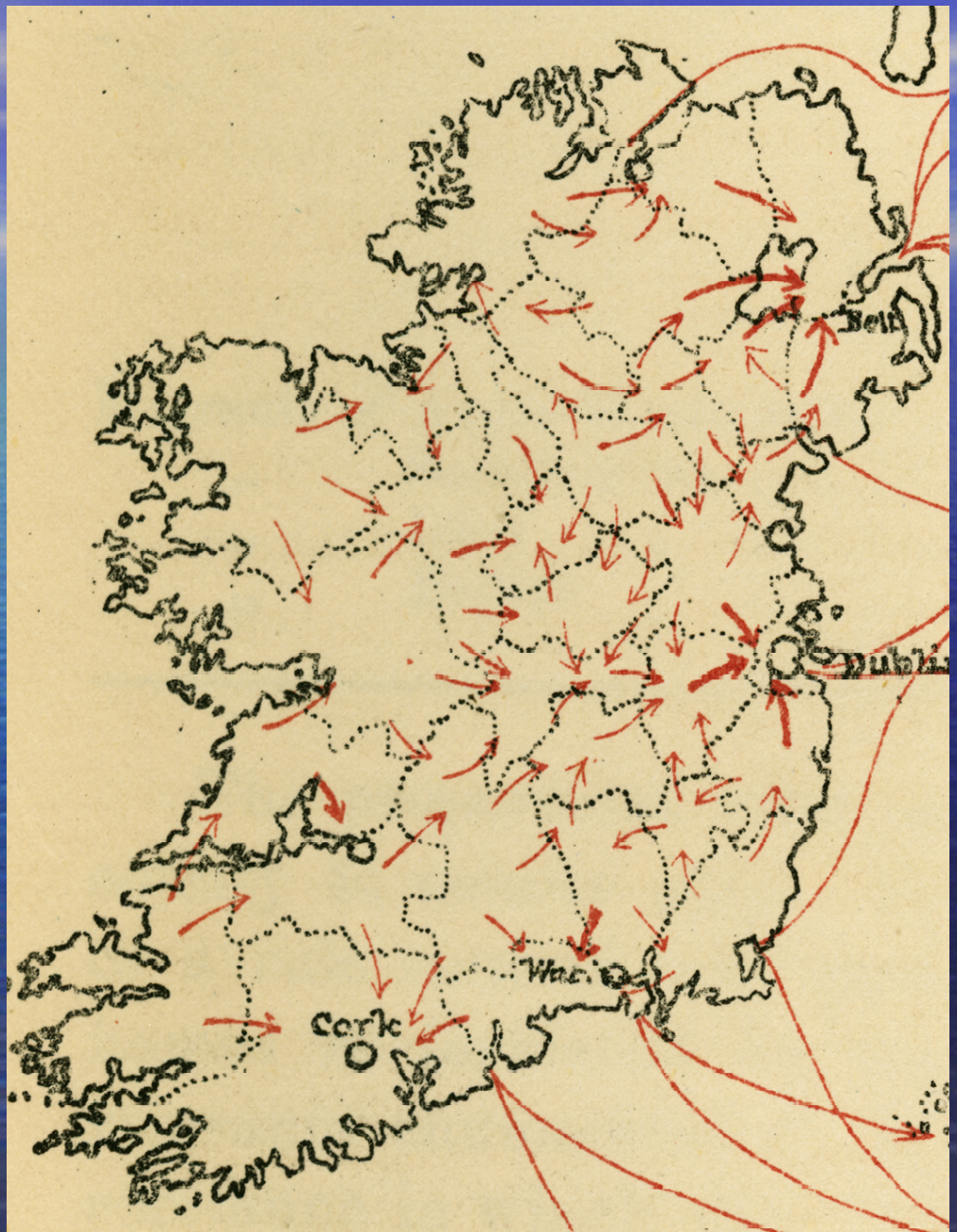
Distance decay effects are noticed.

Migration fields can be detected.

It all seems very clear and simple.

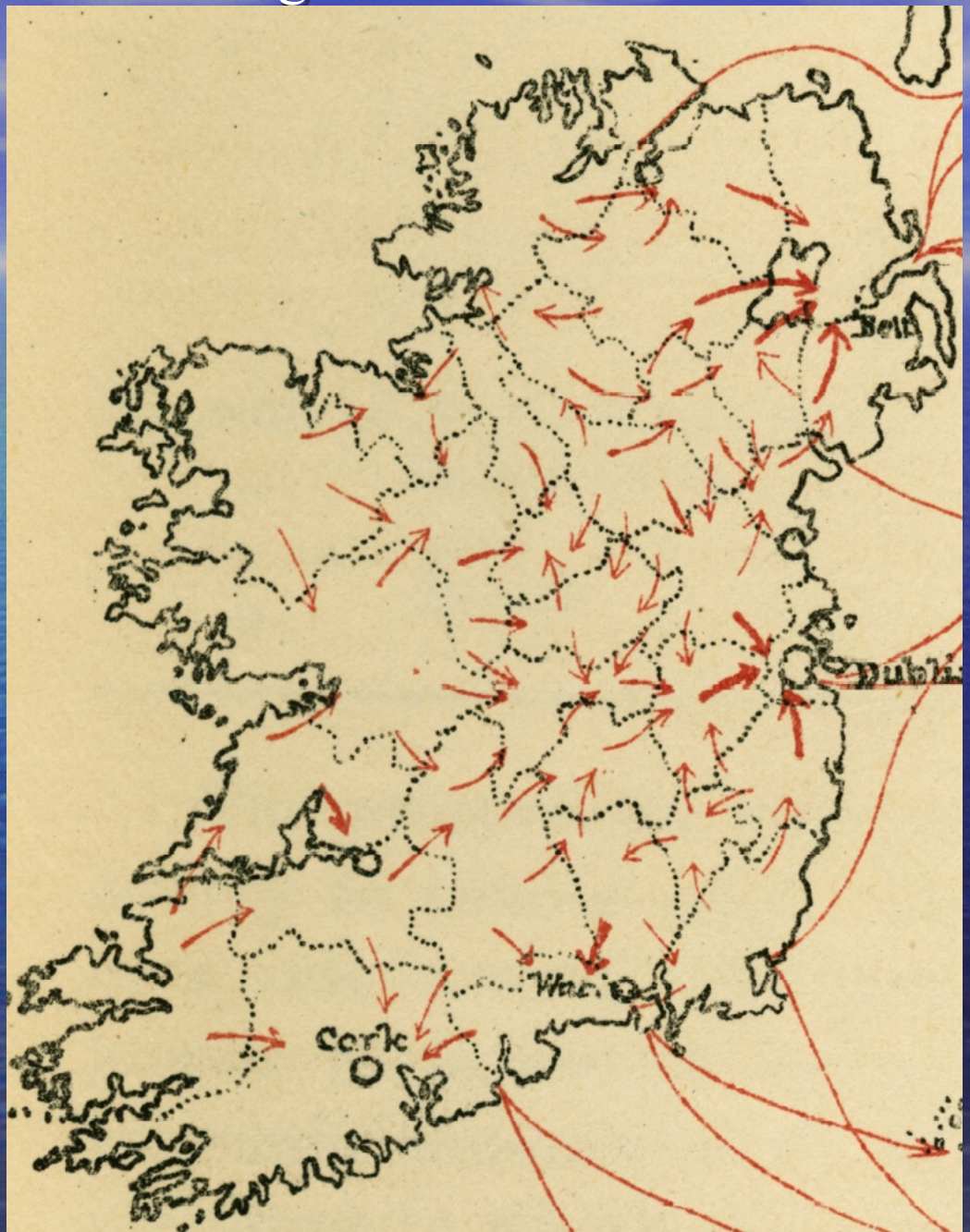
A very nice map!

Irish Currents of Migration

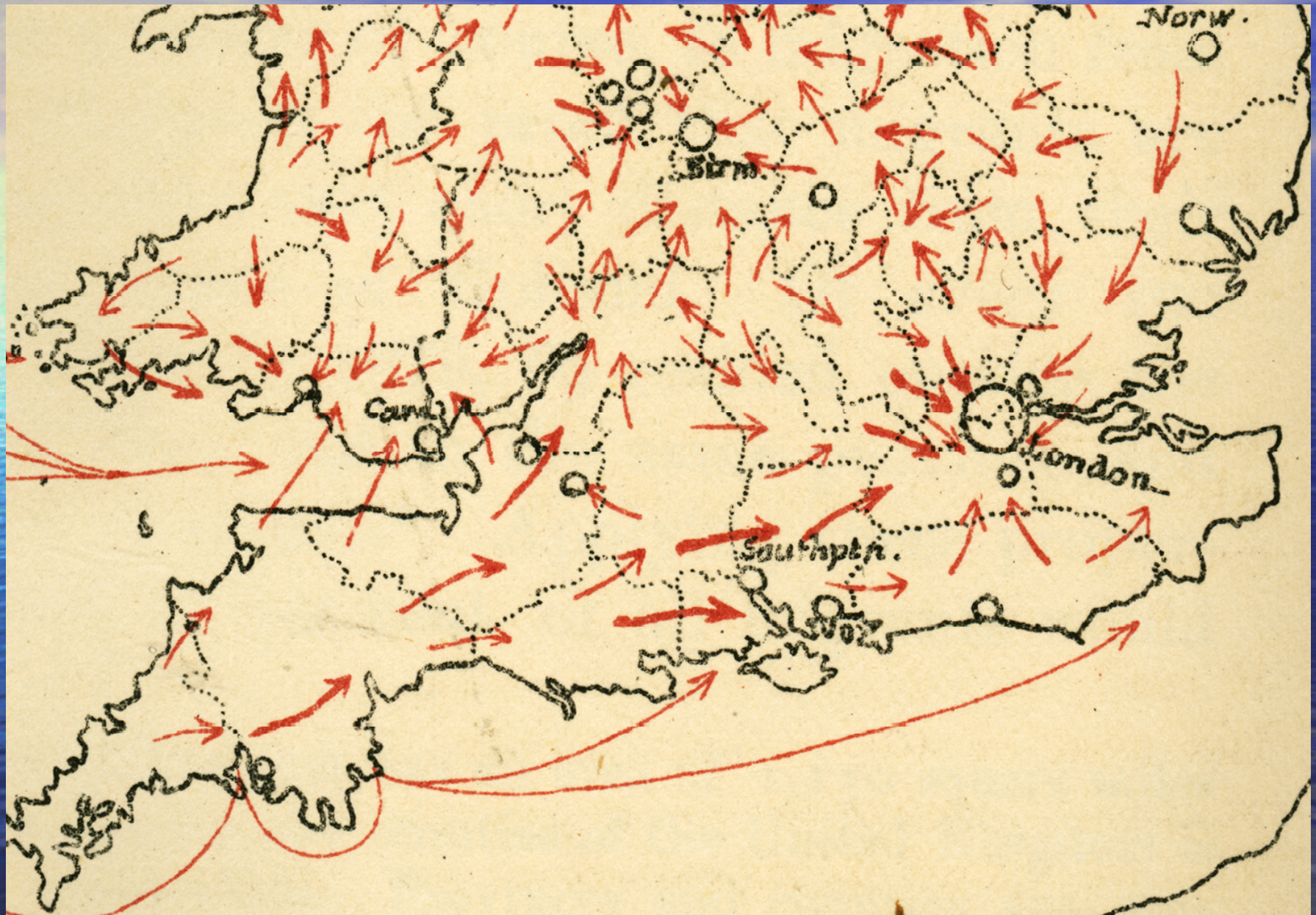


Detail west of Dublin

Now look at this again and notice the detailed effects



Southern Great Britain



To produce a similar map of California migration.

Needed are:

1st a migration table.

I used the US Census 1985-1990 California county-to-county table.

2nd a map of county boundaries.

Then

From the map produce an adjacency table.

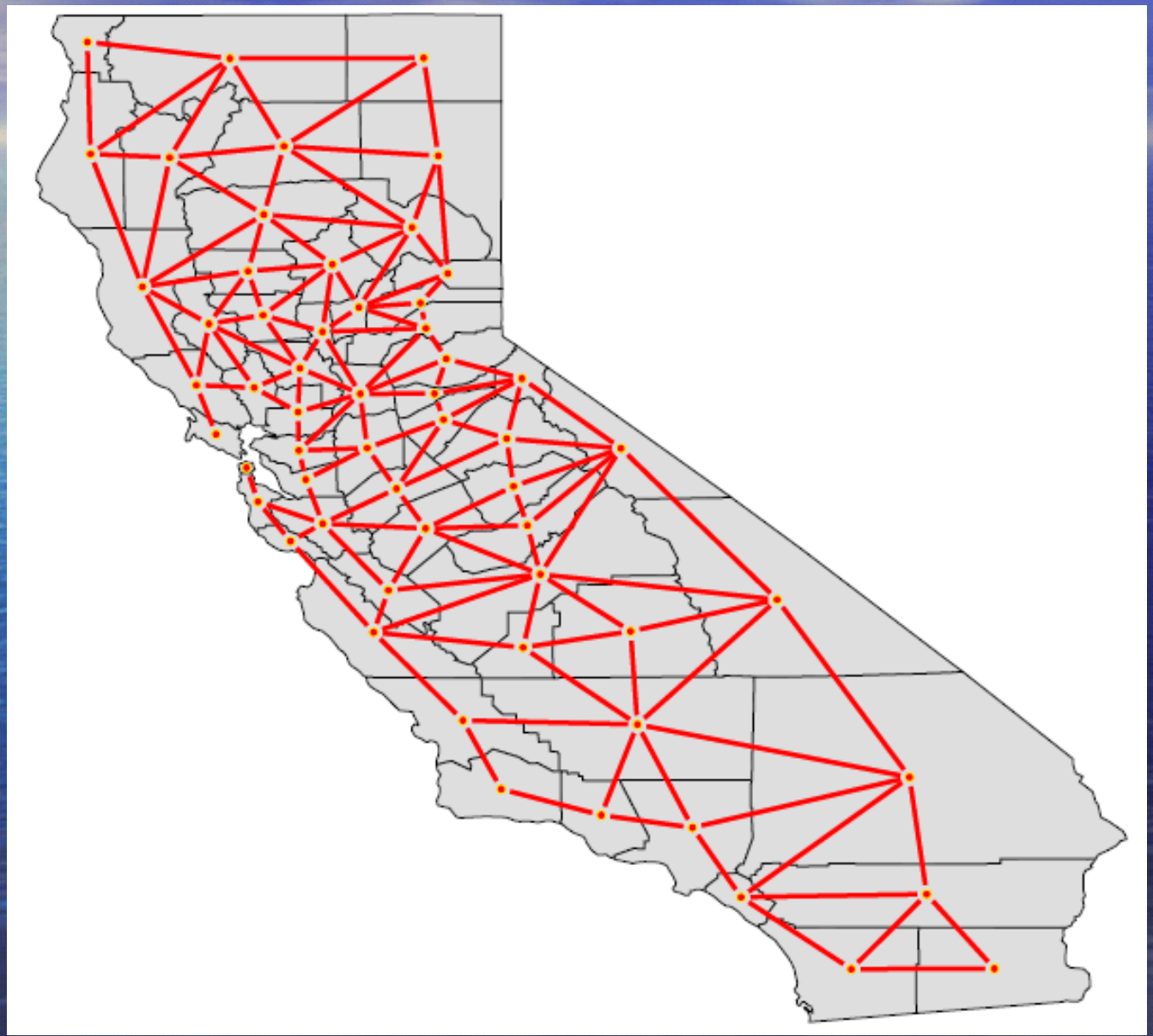
Next, select the dominate migration between all pairs of adjacent counties.

OREGON
Del Norte
Siskiyou
Modoc
Humboldt
Trinity
Shasta
Lassen
Tehama
Plumas
Mendocino
Glenn
Butte
Sierra
NEVADA
Colusa
Yuba
Nevada
Lake
Sutter
Placer
Yolo
El Dorado
Sonoma
Napa
Sacramento
Alpine
Amador
Solano
Calaveras
Marin
Tuolumne
Mono
San Francisco
Contra Costa
San Joaquin
Alameda
Stanislaus
Mariposa
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
San Benito
Fresno
Inyo
Tulare
Monterey
Kings
San Luis Obispo
Kern
San Bernardino
Santa Barbara
Ventura
Los Angeles
Orange
Riverside
San Diego
Imperial
MEXICO

California's 58 counties

Adjacent California Counties

centroid to centroid



In the vicinity of San Francisco

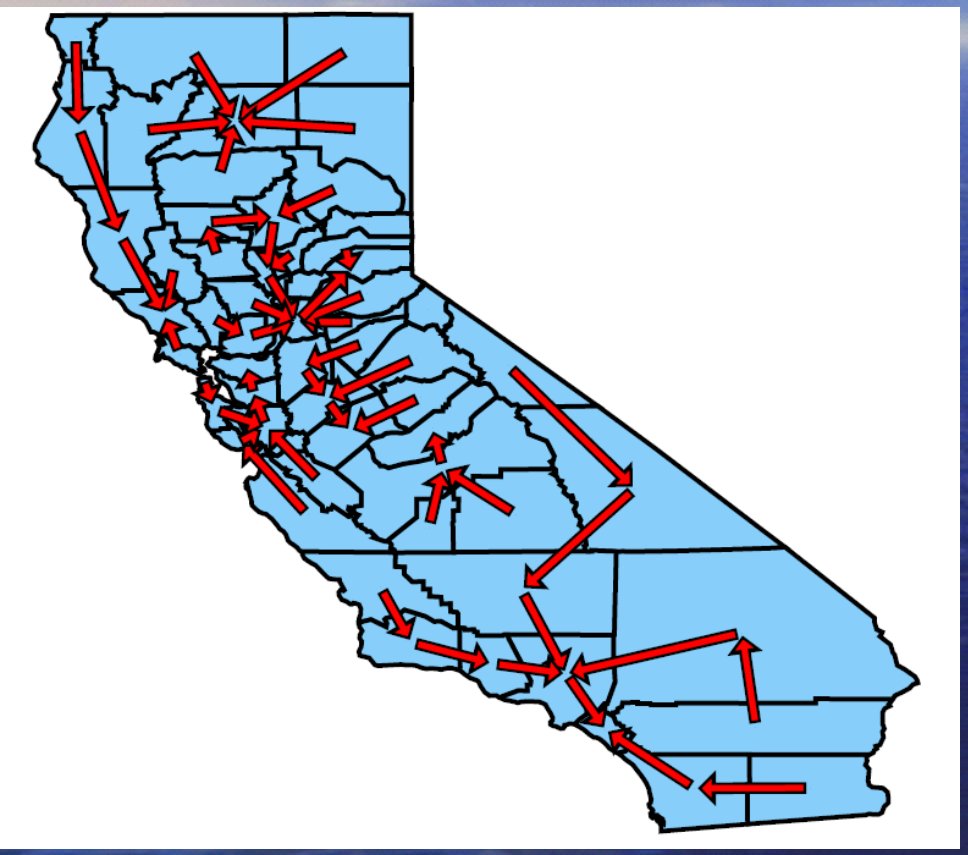
I need to add bridges

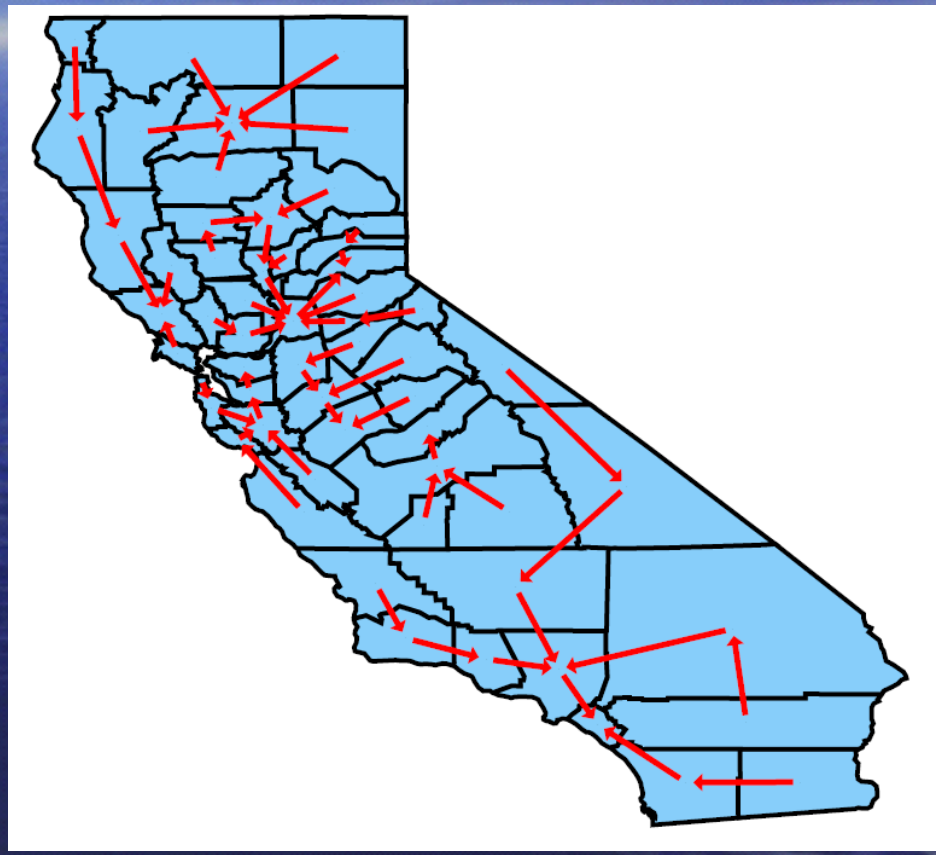
Adding Bridges

Experimenting with centroid to centroid arrows

In general I was not pleased with this approach.

Here are two of the best ones.



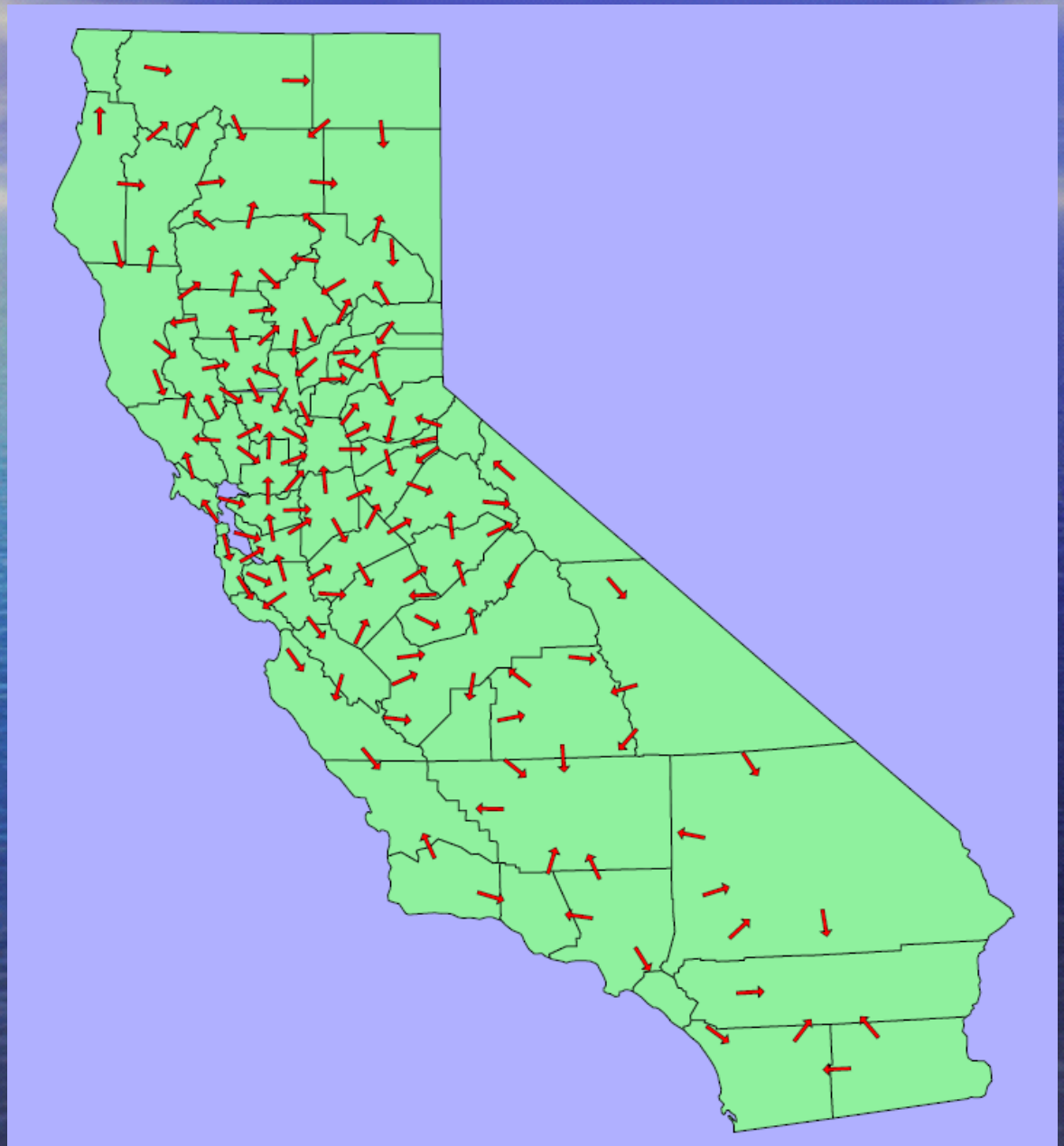


Migration to Adjacent County

In Mid California. Again with centroid to centroid.

Currents of Migration

Trying to be a bit more like Ravenstein: same sized adjacency vectors. Pecked boundaries might help.



Mid California Enlarged

Finally I found a better approach!

The centroid to centroid method did not seem satisfactory.

Even trying to use logarithmic scaled arrows,
or using unit-sized arrows did not work well.

Inserting boundary mid-points could have helped.

But using a freehand drawing program (Corel Photo House)
seemed to be satisfactory.

Even though I am not skilled at using such a program.

Freehand, in the style of Ravenstein

Next: showing some detail

The next maps show parts of the area enlarged.

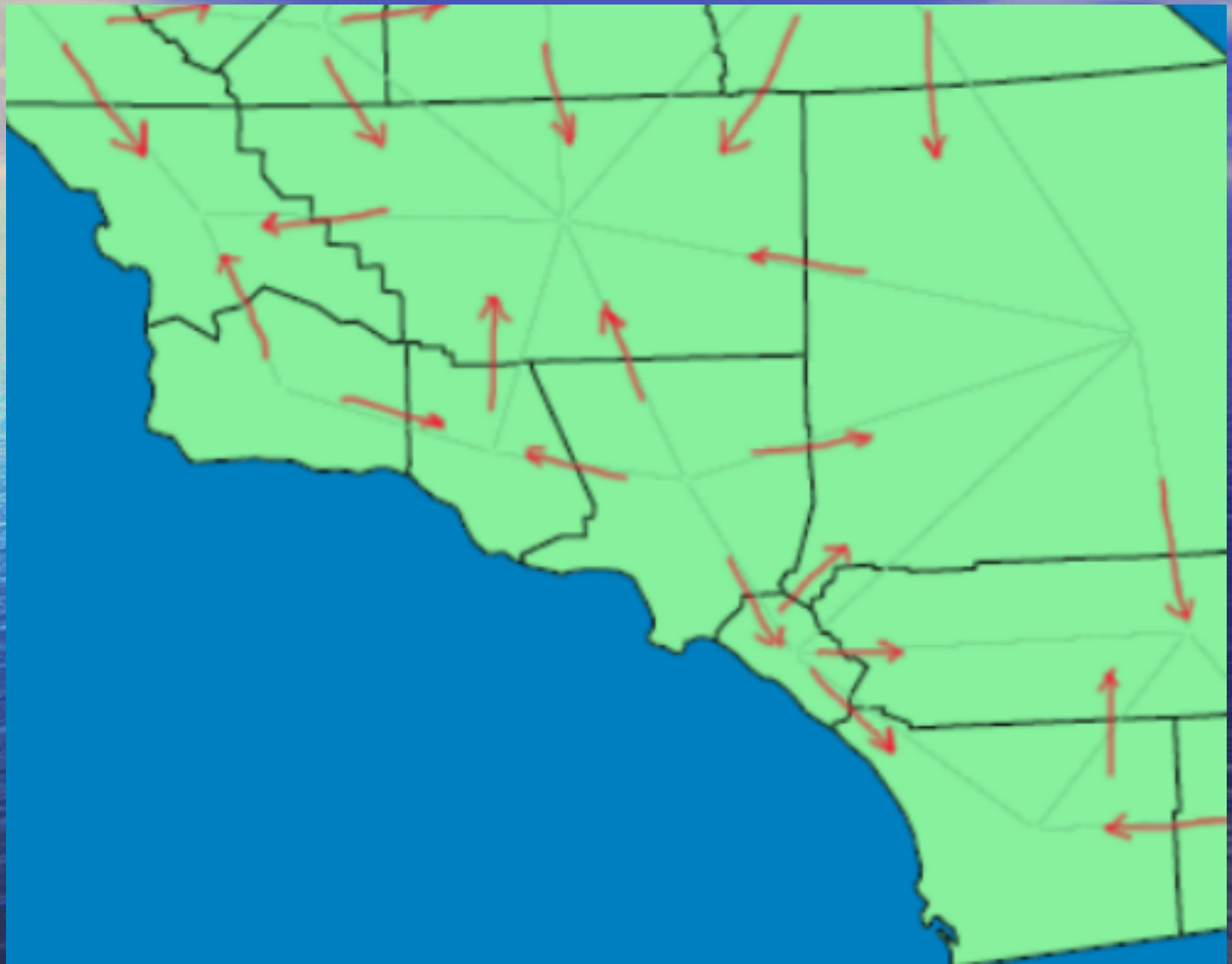
How well do these results compare to Ravenstein's map?

Are they as easy to read?

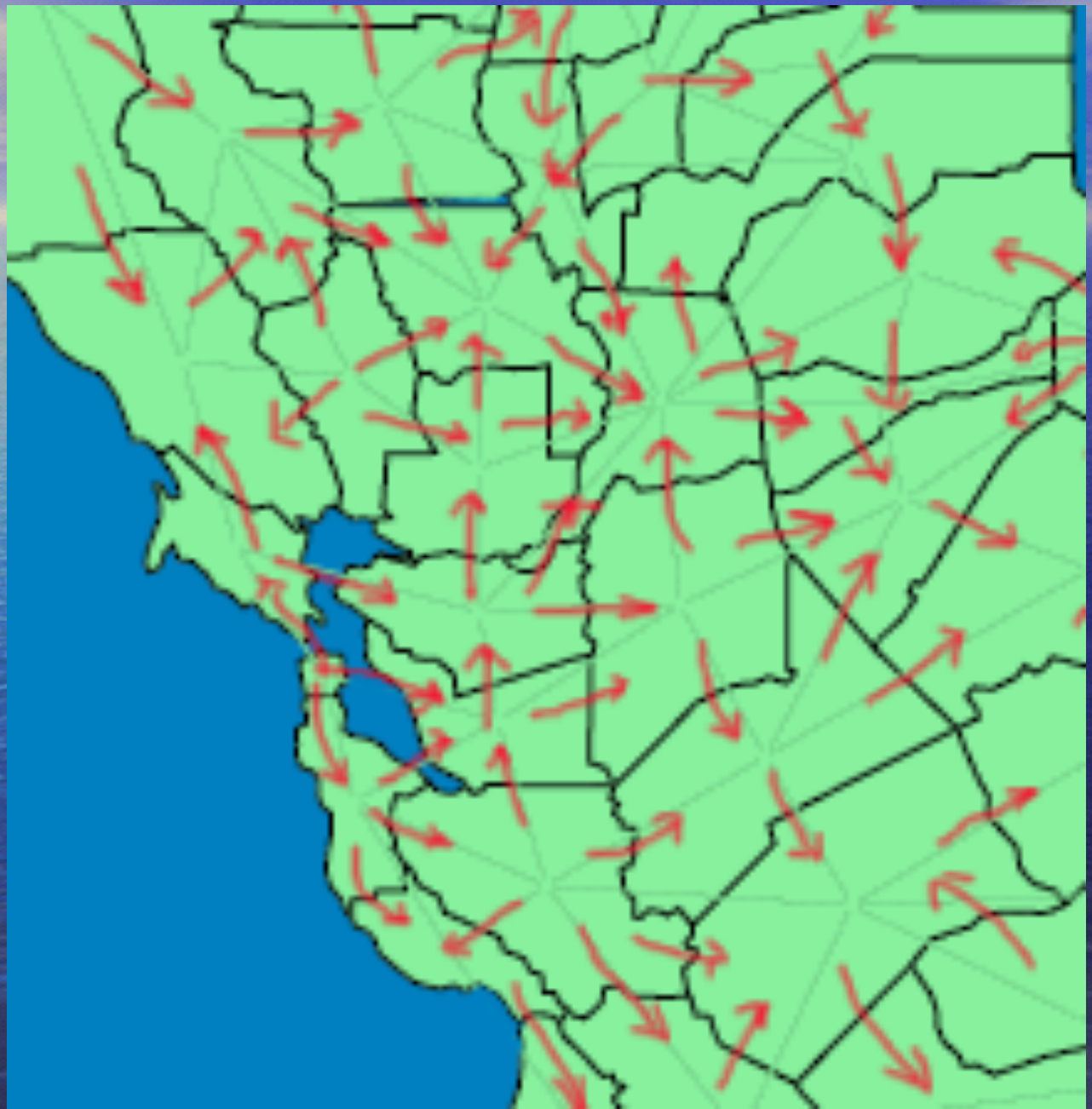
How well do they suggest geographic questions?

Could they be improved?

Los Angeles area



San Francisco area



The next step is to compare this map with the data from the U.S. Census Bureau

The map uses the 1985-1990 census migration table.

But showing only the migration to adjacent counties.

Arrow width is proportional to migration magnitude.

Minimum 4; Maximum 97,263; Average 4,567

Migration above 5000 persons only shown.

Only two regions have appreciable migration.

The result is a dramatically different map!

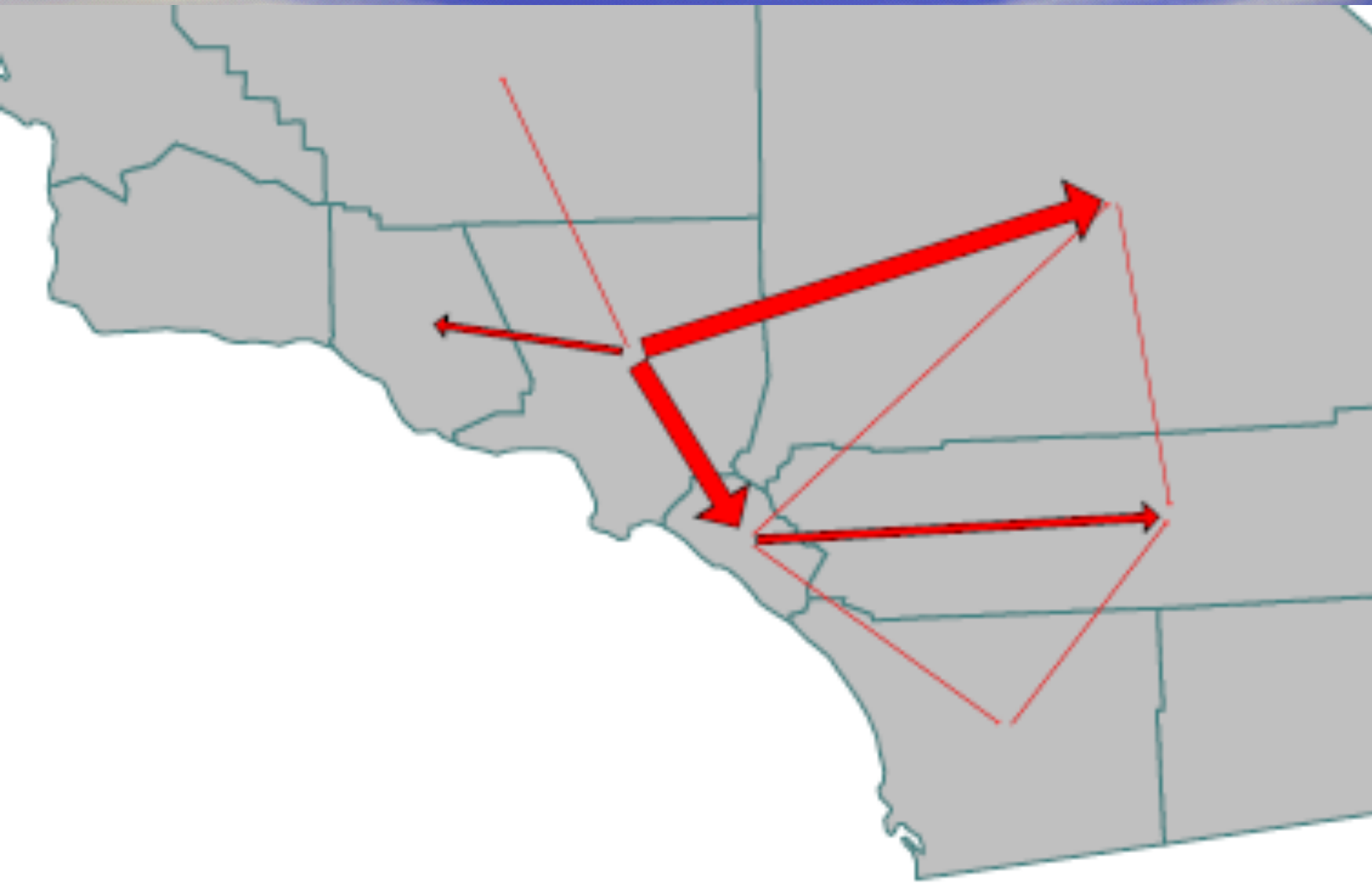
Thus these are two alternate depictions of the same events!

Each has a role.

Migration to Adjacent County 1985-1990

Detail in the LA Area

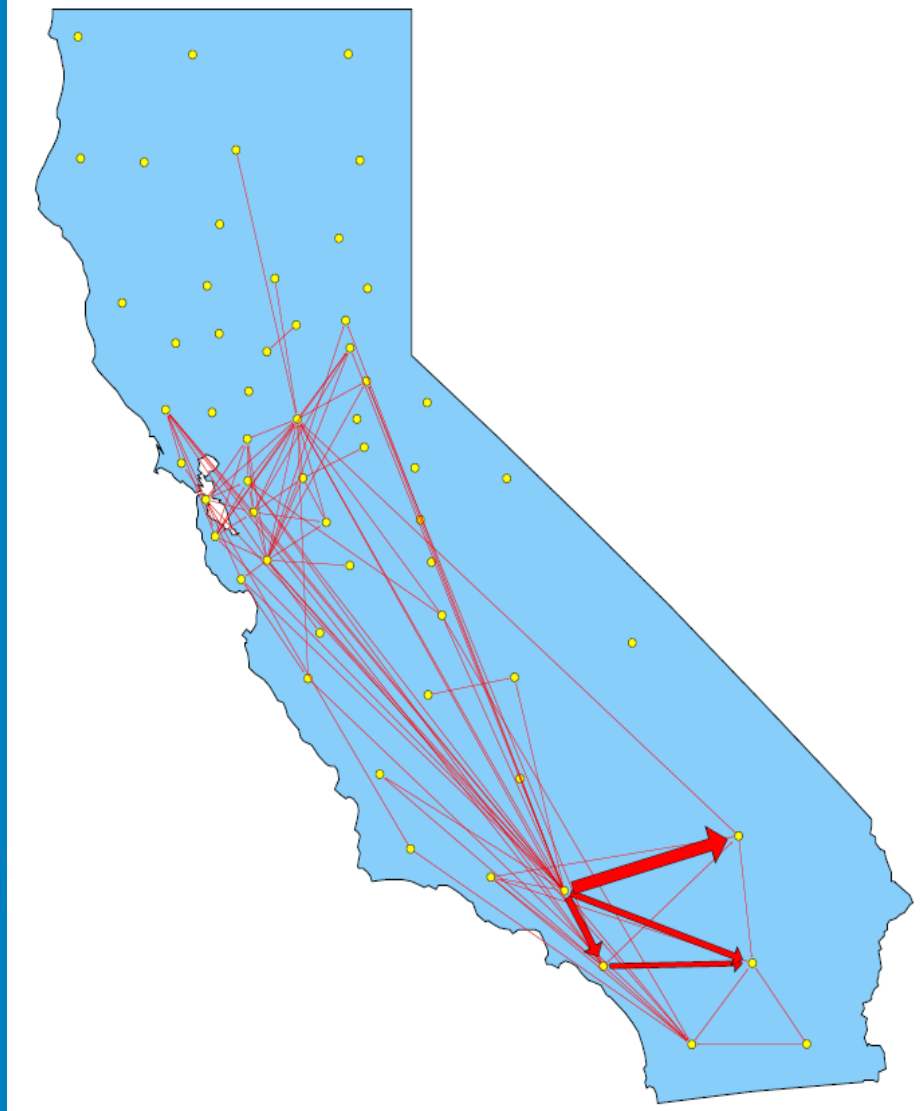
Migration above 5000 persons



Detail in the SF Bay Area

Migration above 5000 persons

Left: Ravenstein freehand, to adjacent county.
Right: Computer map, Total migration.
Both usuing the same US Census data



The next comparison is with a migration model

This mathematical model, computes potentials,
from which gradient vectors can be displayed.
These can then be compared to the Ravenstein vectors.
The model is described in the 1983
"Push-Pull Migration Laws" paper.
Shown is the result for the total migration,
not just the adjacent county migration.
This is a preliminary version, subject to recalculation.

Potentials from the Actual Total Migration

Computed using the QTP Model

Migration Computed from Potential

Potentials and Gradients

Thank you for your attention

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JUNE, 1885.

The Laws *of* Migration. *By* E. G. Ravenstein, Esq., F.R.G.S.

[Read before the Statistical Society, 17th March, 1885. The President, Sir Rawson W. Rawson, K.C.M.G., C.B., in the Chair.]

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Introductory Remarks.

It was a remark of the late Dr. William Farr, to the effect that migration appeared to go on without any definite law, which first directed my attention to a subject,* to which, after the publication of the census of 1881, I now propose to return. I shall confine myself in what follows to migration going on within the limits of the United Kingdom,† reserving for a future occasion a consideration of the same subject in connection with foreign countries. In his general report on the census of 1871 the registrar-general says very justly: "The improved roads, the facilities offered under the "railway system, the wonderful development of the mercantile "marine, the habit of travelling about, and the increasing know-"ledge of workmen, have all tended to facilitate the flow of people "from spots where they are not wanted to fields where their labour "is in demand. The establishment of a manufacture or the open-"ing of a new mine rallies men to it, not only from the vicinity, "but from remote parts of the kingdom. The great towns afford "such extraordinary facilities for the division and for the combina-

* See the Birthplaces of the People and the Laws of Migration in the "Geographical Magazine," 1876, with seven maps.

† That is England, Scotland, and Ireland; Man and the Channel Islands are therefore excluded.

Ten Migration Laws by Ravenstein

(1) "... even in the case of 'counties of dispersion', which have a population to spare for other counties, there takes place an inflow of migrants across that border which lies furthest away from the great centers of absorption". (1885:191)

(2) "The more distance from the fountainhead which feeds them, the less swiftly do these currents flow". (1885:191)

(3) [We have] "proved that the great body of our migrants only proceed a short distance". (1885:198)

(4) "In forming an estimate of displacements we must take into account the number of natives of each county which furnishes the migrants, as also the population of the ... districts which absorb them". (1885:198)

(5) "Migrants enumerated in a ... center of absorption will ... grow less with the distance proportionally". (1885:199)

(6) "The process of dispersion is the inverse of that of absorption, and exhibits similar features". (1885:199)

(7) "Each main current of migration produces a compensating counter current". (1885:199)

(8) "Counties having an extended boundary in proportion to their area, naturally offer greater facilities for an inflow ... than others with a restricted boundary". (1885: 175)

(9) [Migration streams] "sweep along with them many of the natives of the counties through which they pass [and] deposit, in their progress, many of the migrants, which have joined them at their origin". (1885:191)

(10) "Migratory currents flow along certain well defined geographical channels". (1889:284)