SB X2 1
Nitrate in Groundwater
Report to the Legislature

TECHNICAL REPORT 2:
LANDUSE & POTENTIAL GROUNDWATER LOADING

Interagency Task Force Meeting

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Outline

- Nitrate Sources: What/Who is the Problem?
- How did we do this?
- Key Findings

What is the Problem?

How big is the problem? Where is the problem?

What are sources and contributions of groundwater nitrate?

- **Land Uses**
  - Ag: Cropping Patterns
    - Fertilizer Application
    - N Fixation + uptake
    - Irrigation
  - CAFOs / Dairies / Food Proc.
  - Urban:
    - Sewer / Septic / Imp. Runoff
    - Wastewater Treatment Plants
- Soils
- Groundwater Basins
  - Aquifer Characterization
  - Recharge Zones
  - Connectivity to Surface Water
- Wells
  - Public Drinking Water
  - Private Domestic
  - Monitoring
  - Irrigation Supply
- Drinking Water Treatment Facilities
  - Water Supply (Facilities, Networks)

(sources - sinks)

(receptors)

How Much Loading is Too Much?

- Operational measure (approximate!):

  MCL nitrate in typical average recharge:

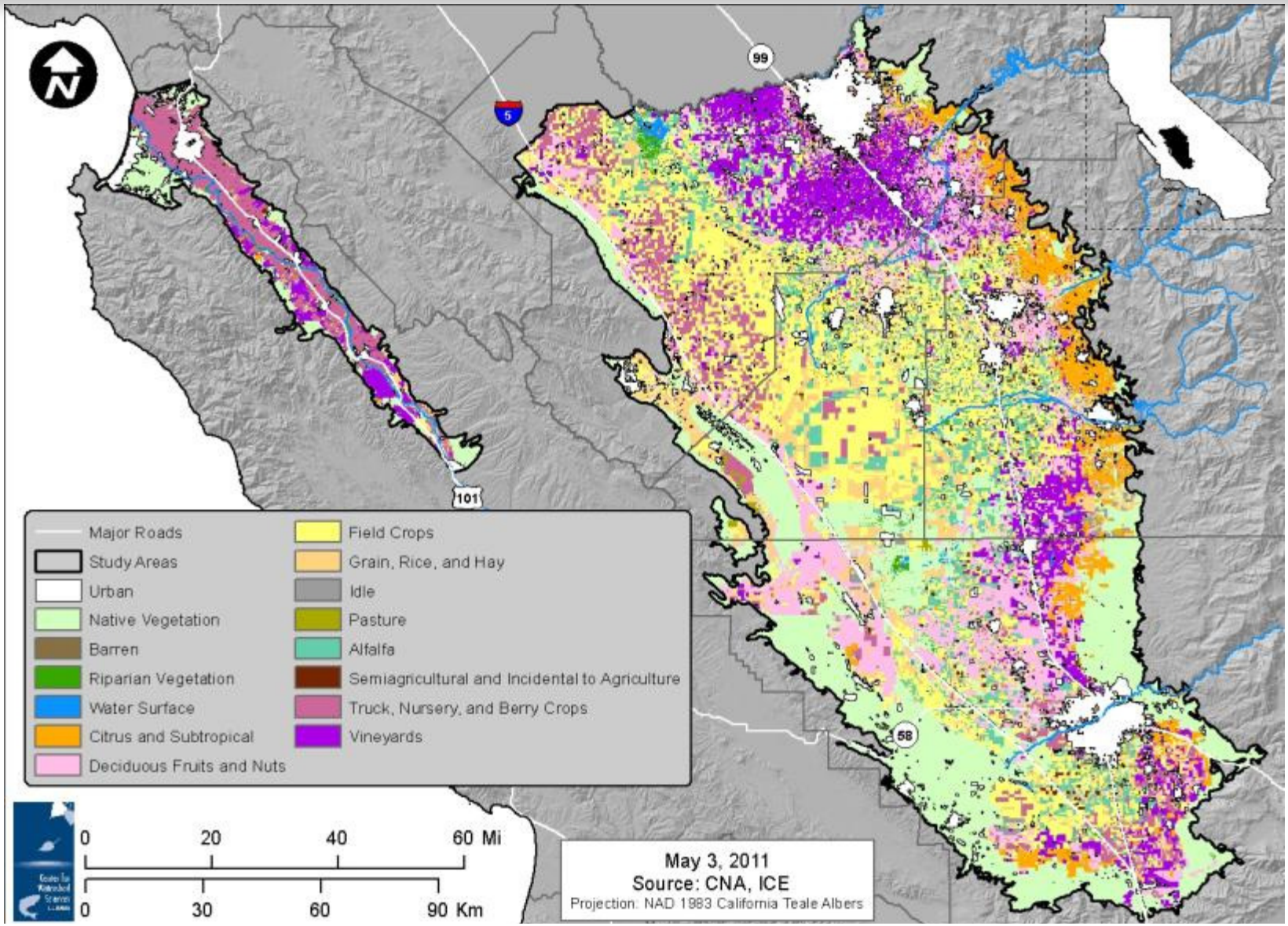
  45 mg/L in ~1 acft/ac

  = ~35 kg/ha [~30 lbs/ac]

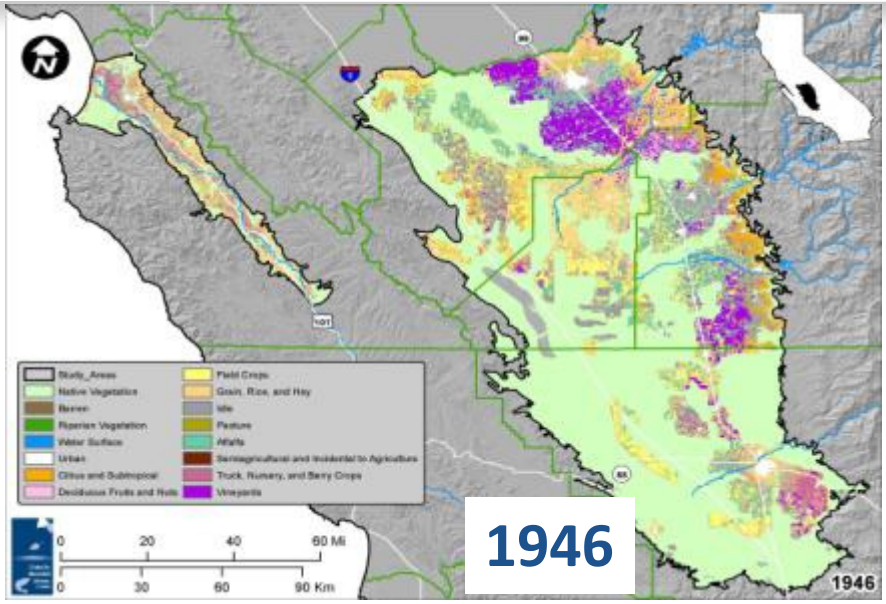
- On ~1.5 Mha (4Mac) of irrigated land:

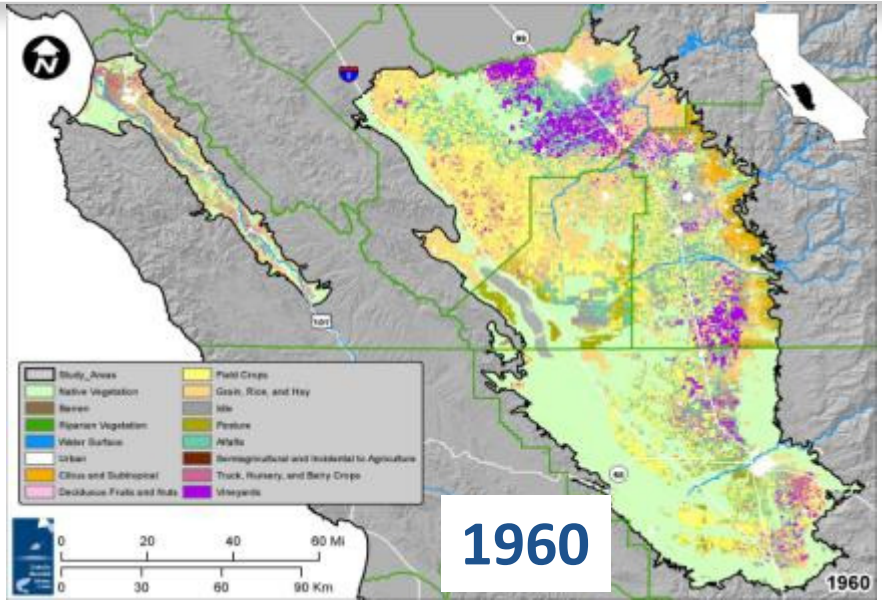
  ~50 GgN [60k short-tons N]

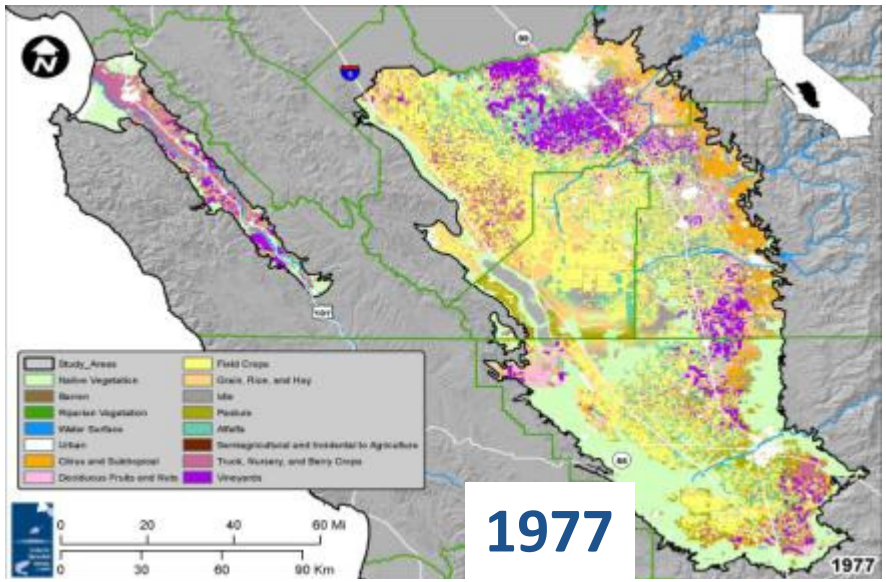
Present

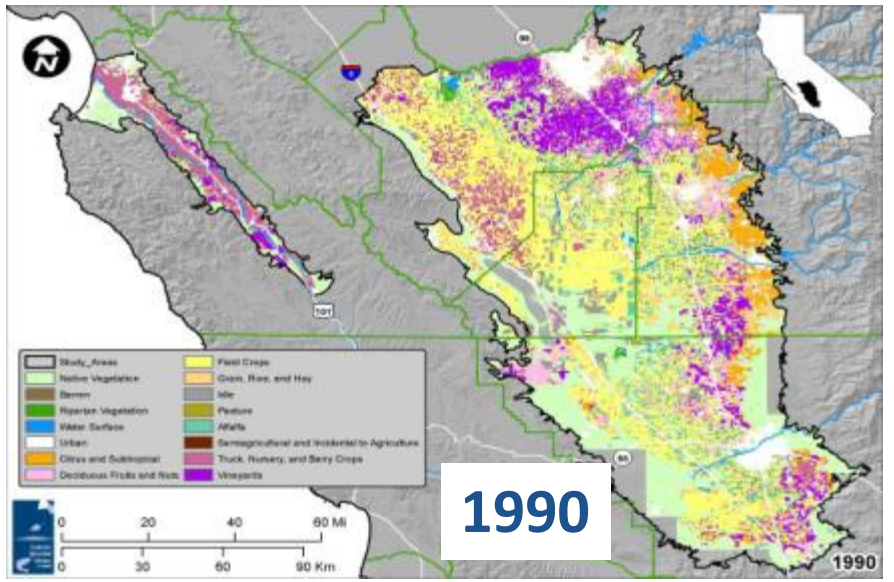

99
5
101
58
Major Roads
Study Areas
Urban
Native Vegetation
Barren
Riparian Vegetation
Water Surface
Citrus and Subtropical
Deciduous Fruits and Nuts
Field Crops
Grain, Rice, and Hay
Idle
Pasture
Alfalfa
Semiagricultural and Incidental to Agriculture
Truck, Nursery, and Berry Crops
Vineyards
0 20 40 60 Mi
0 30 60 90 Km
May 3, 2011
Source: CNA, ICE
Projection: NAD 1983 California Teale Albers

Simulating Historic Land Use

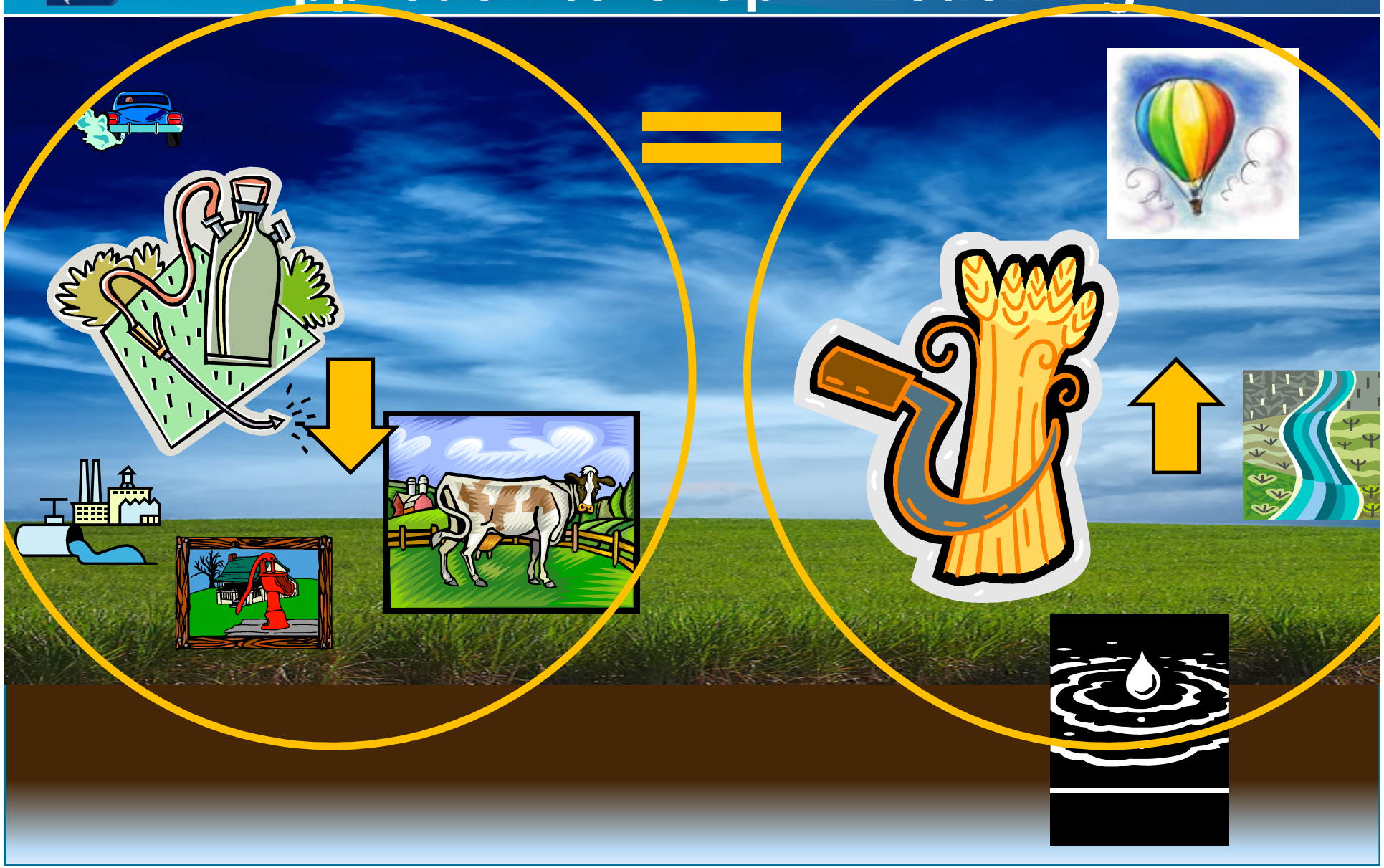








Long-Term Field N Mass Balance Approach to Crop N Leaching



Potential Nitrate Loss

CROP	Applied N (kg/ha)	Harvested N (kg/ha)	Leached N (kg/ha)
Almonds	197	82	82
Apples	66	20	26
…	…	…	…
Wheat	194	120	41

58 total land use / crop types estimated.

Potential Loss to Groundwater → Nitrate Leaching Load

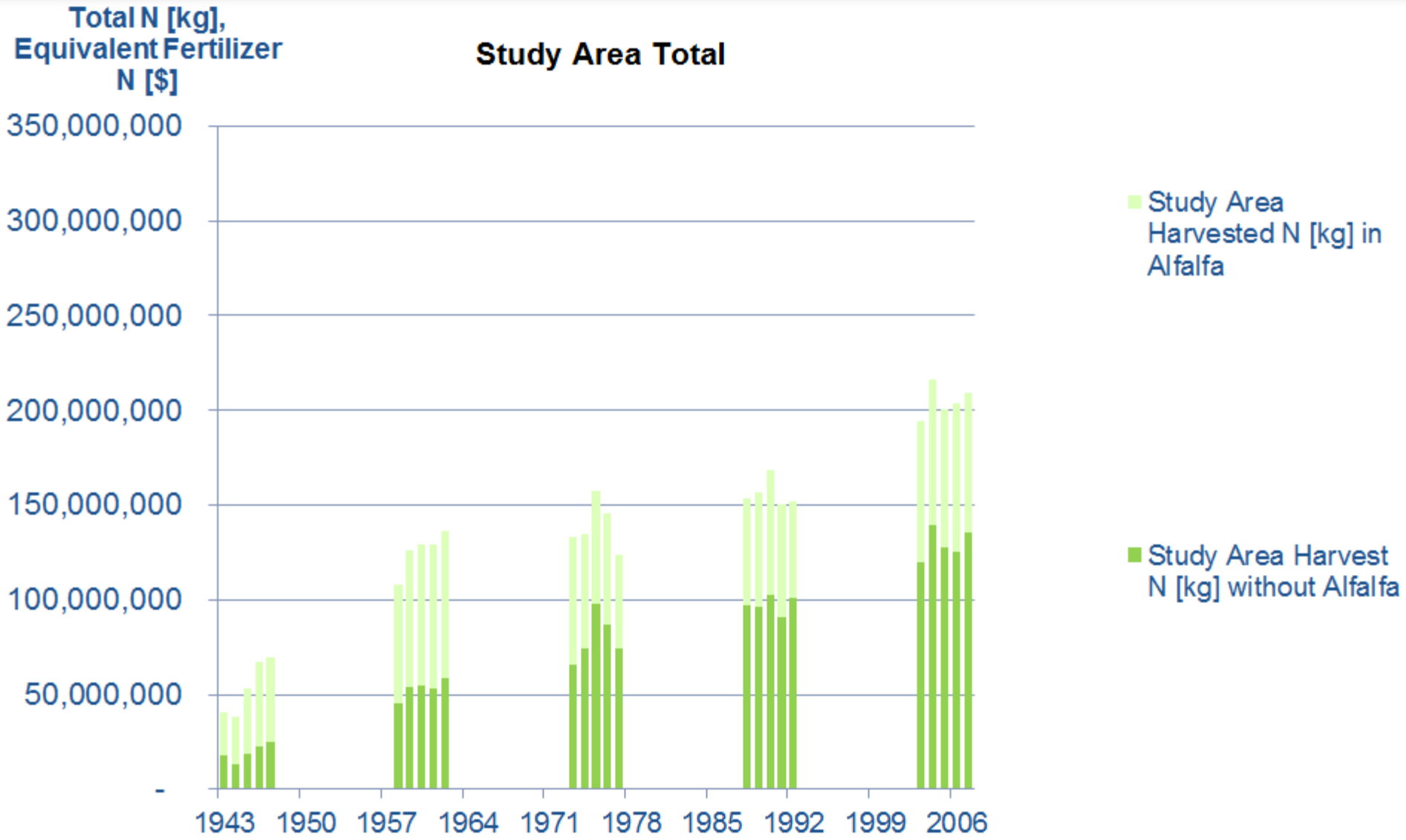
$N_{leached}$

$= N_{applied} - N_{atm\_losses} - N_{harvested} - N_{runoff}$

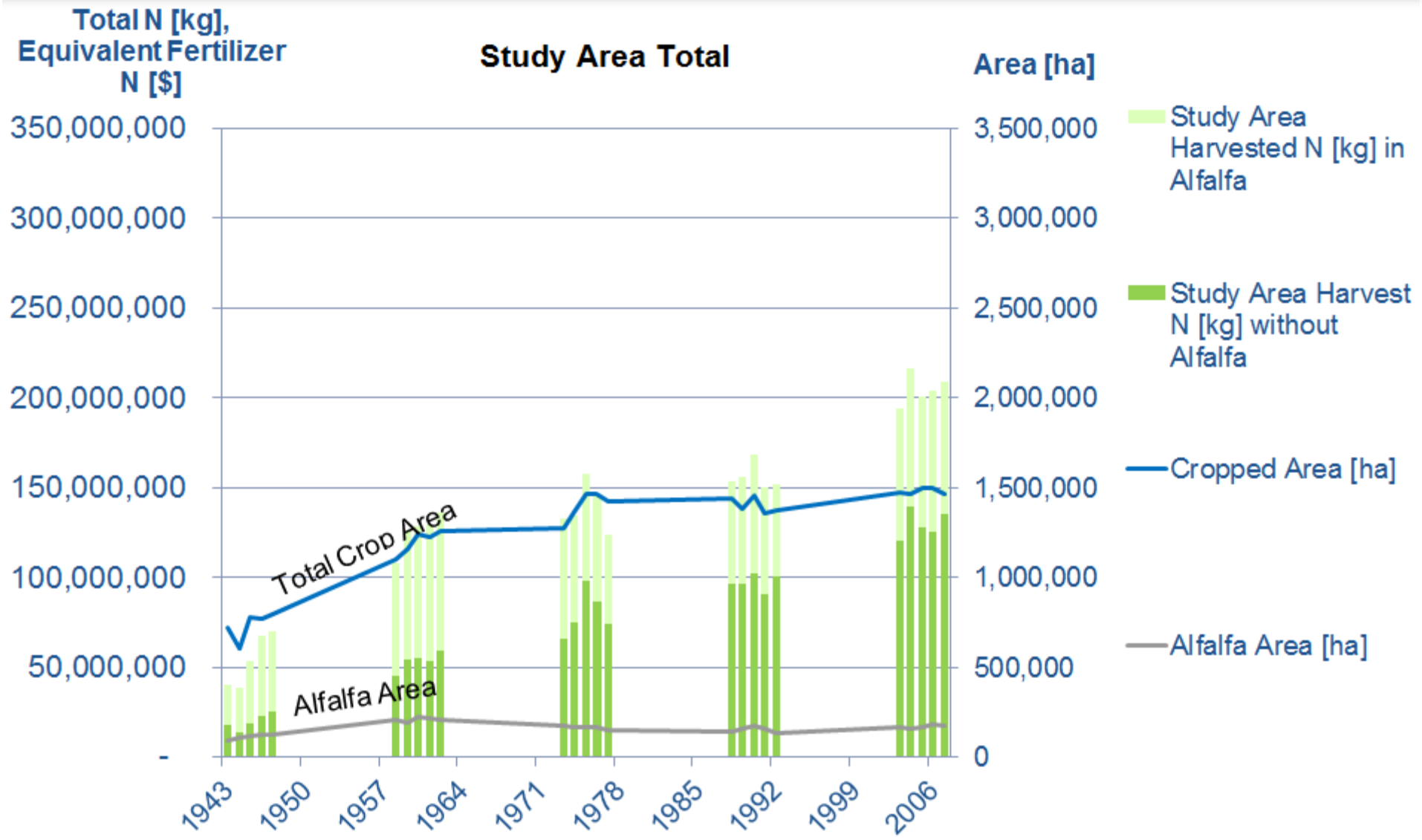
$= 0.9 * N_{applied} - N_{harvested} - N_{runoff}$

- Crop groups were derived from DWR.
- Applied N and Harvested N was estimated from California Nitrogen Assessment (UC Davis ASI) and Ag Commissioner Report Data 1945 - 2005.
- Leached N calculations are approximate / large scale average

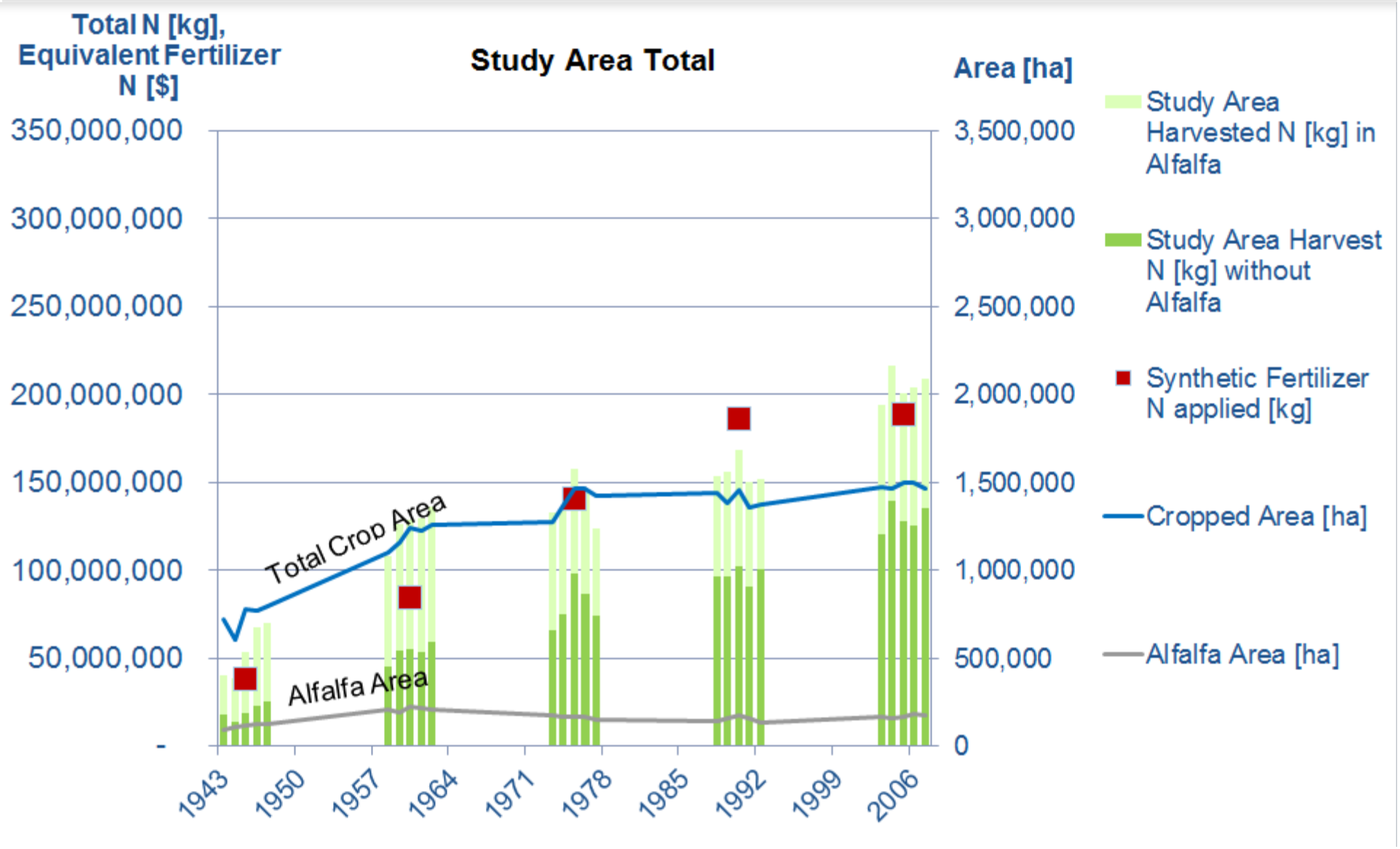
Harvested Crop N [kg]



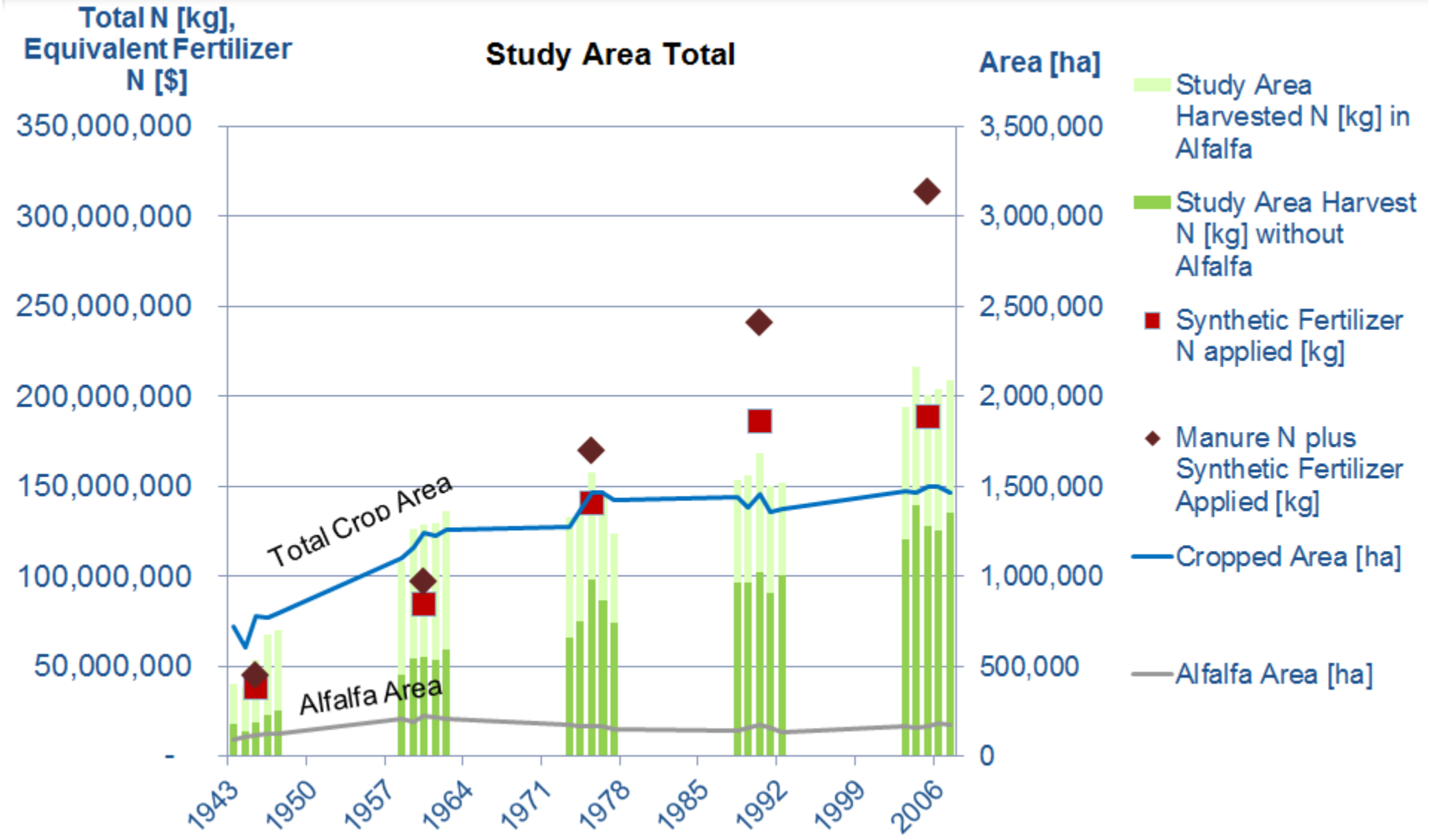
Cropping Area [ha]



Synthetic Fertilizer N Applied [kg]



Manure and Synthetic Fertilizer N Applied



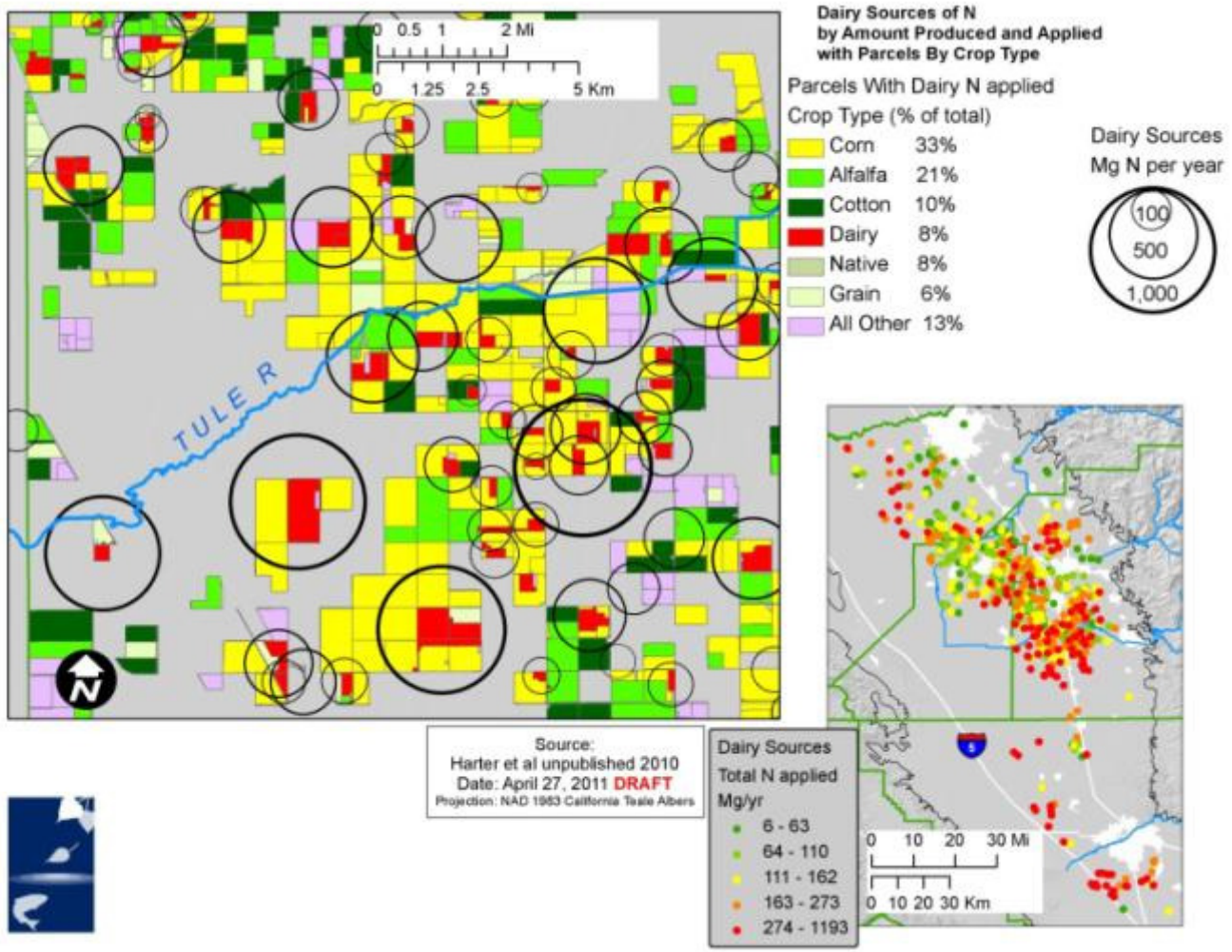
Animal Sources

dairy N loading to land application: 126.8 Gg/yr
dairy N loading directly via corrals and lagoons: 1.8 Gg/yr

Manure N Offsite (Sold): 78.2 Gg N/yr

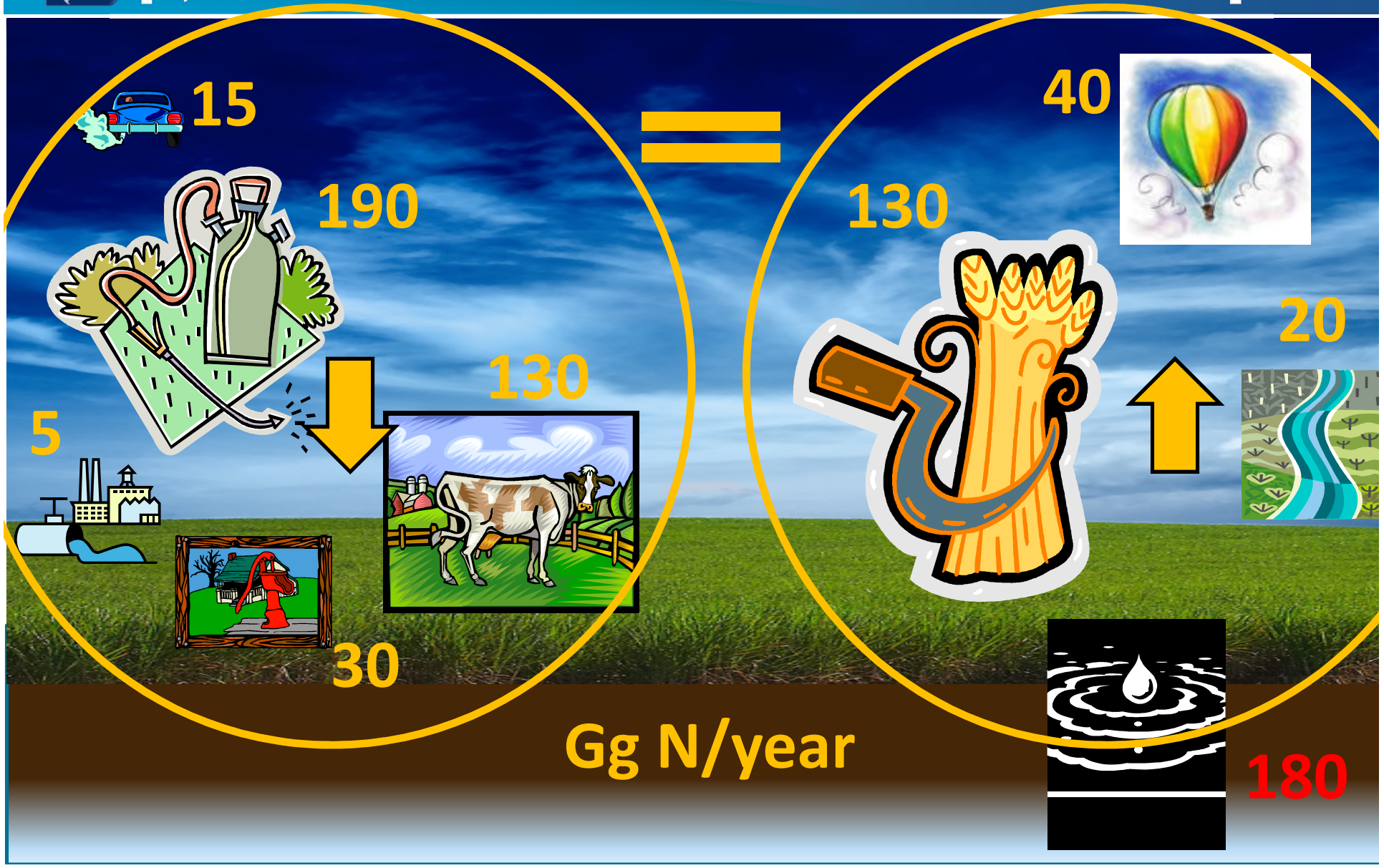
Manure N Dairy Applied: 48.6 Gg N/yr

Manure N Hog,Poultry Offsite (Sold): < 1 Gg N/yr

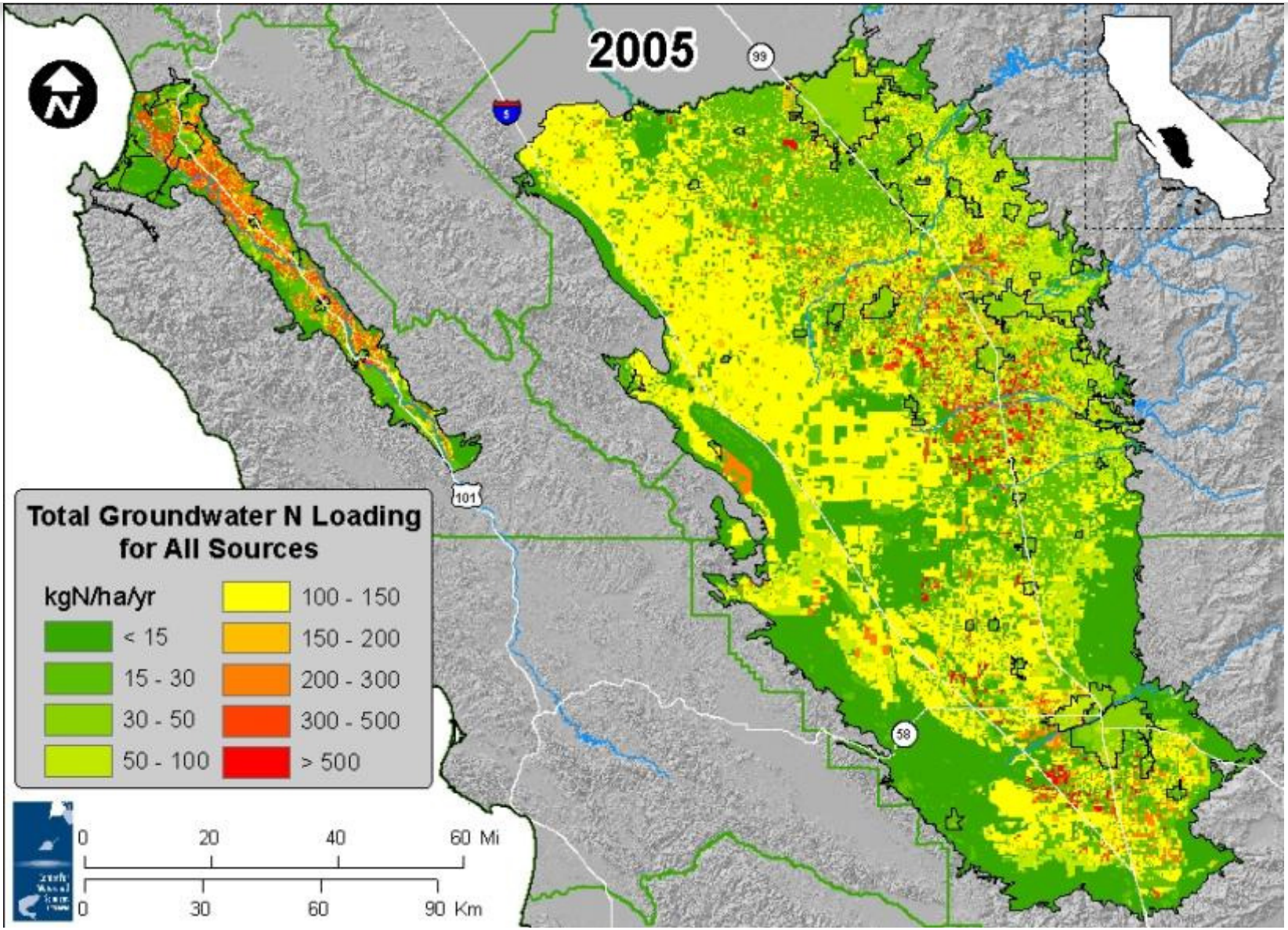


Study Area Ag Field Mass Balance

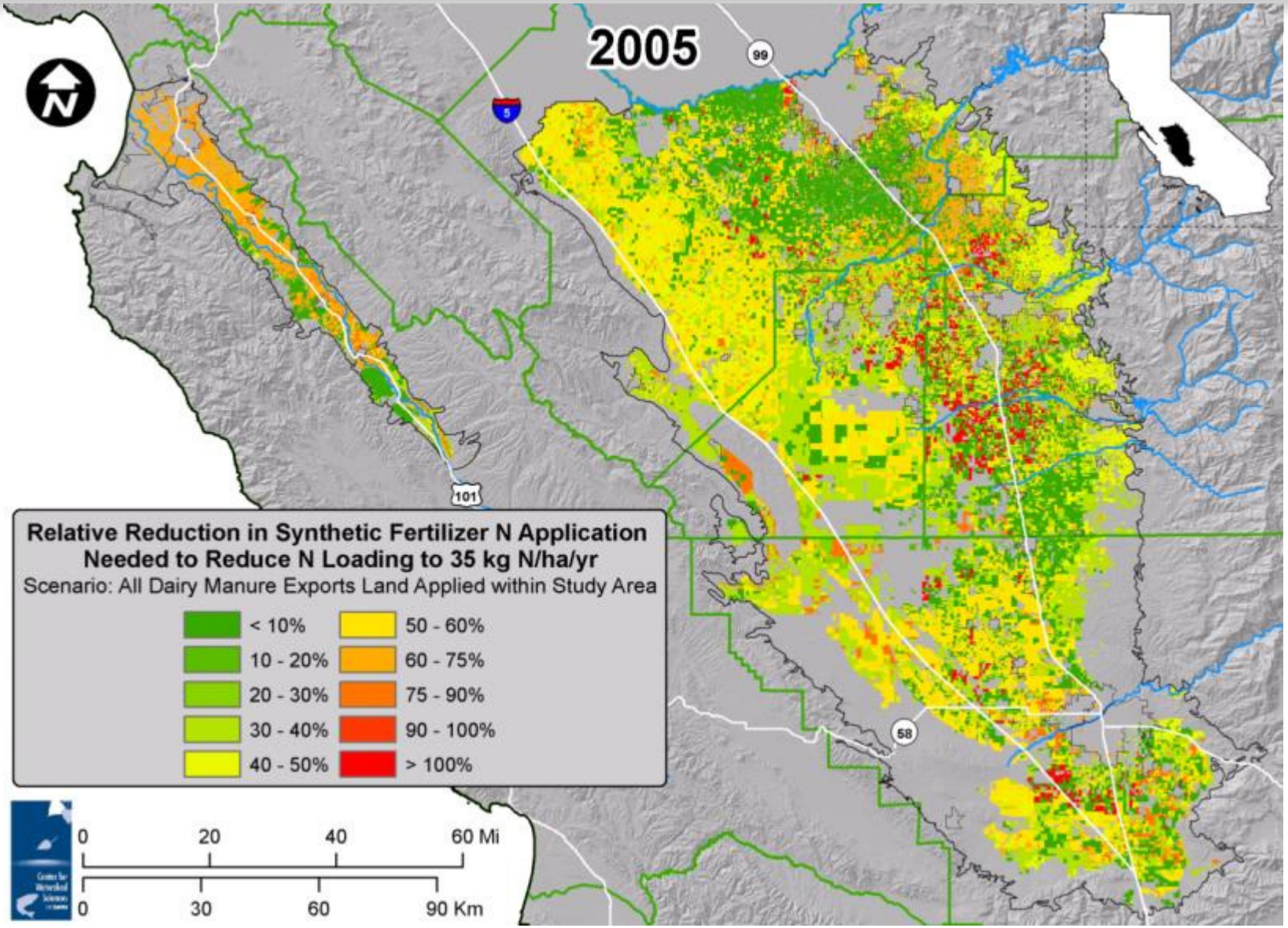
[1,000 tons/Year or $Million/Year Fertilizer Value]



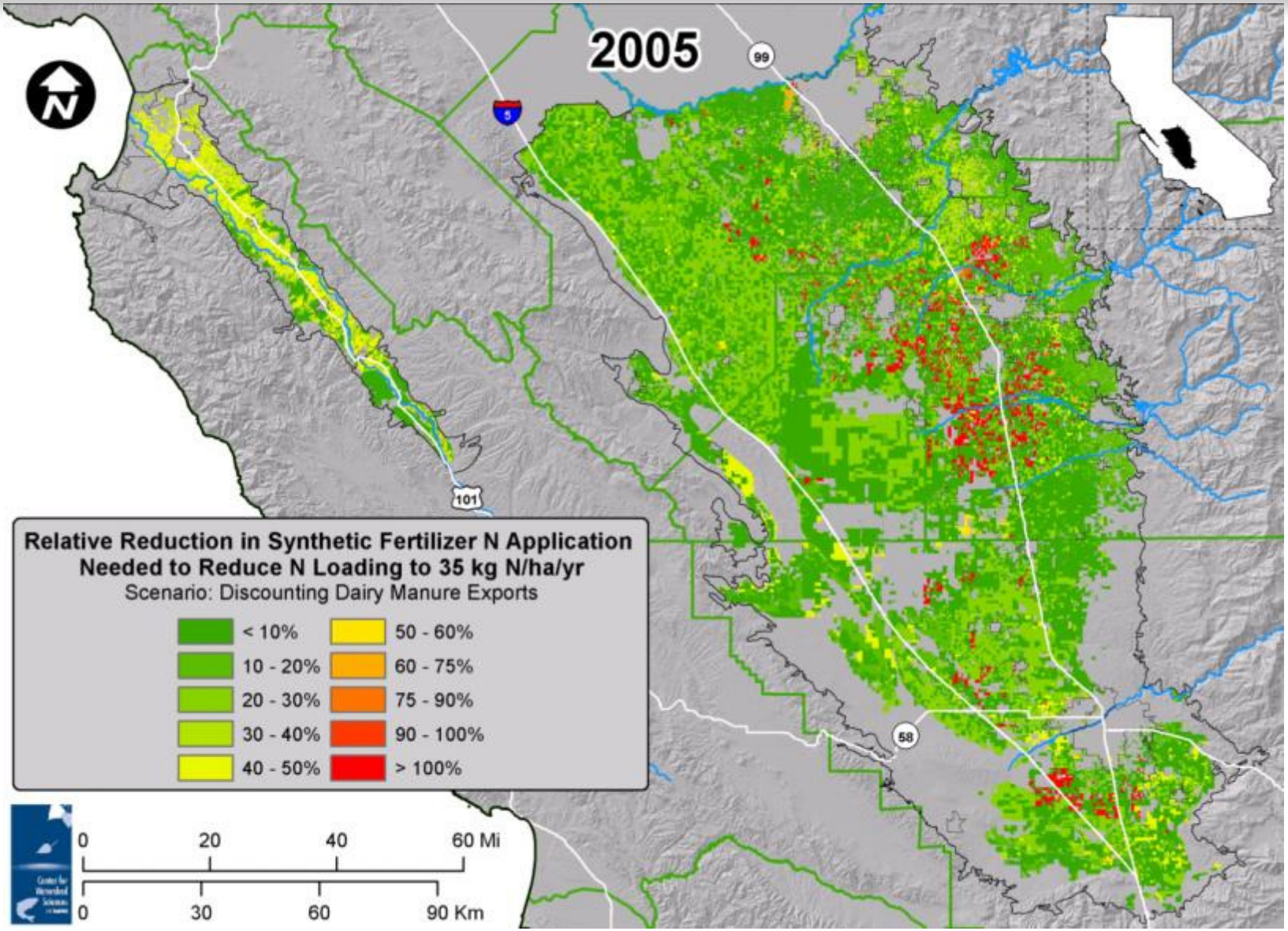
Groundwater N Loading



% Reduction
Manure N Offsite & Synthetic Fertilizer



100% Reduction of Manure N Offsite & % Reduction Synthetic Fertilizer



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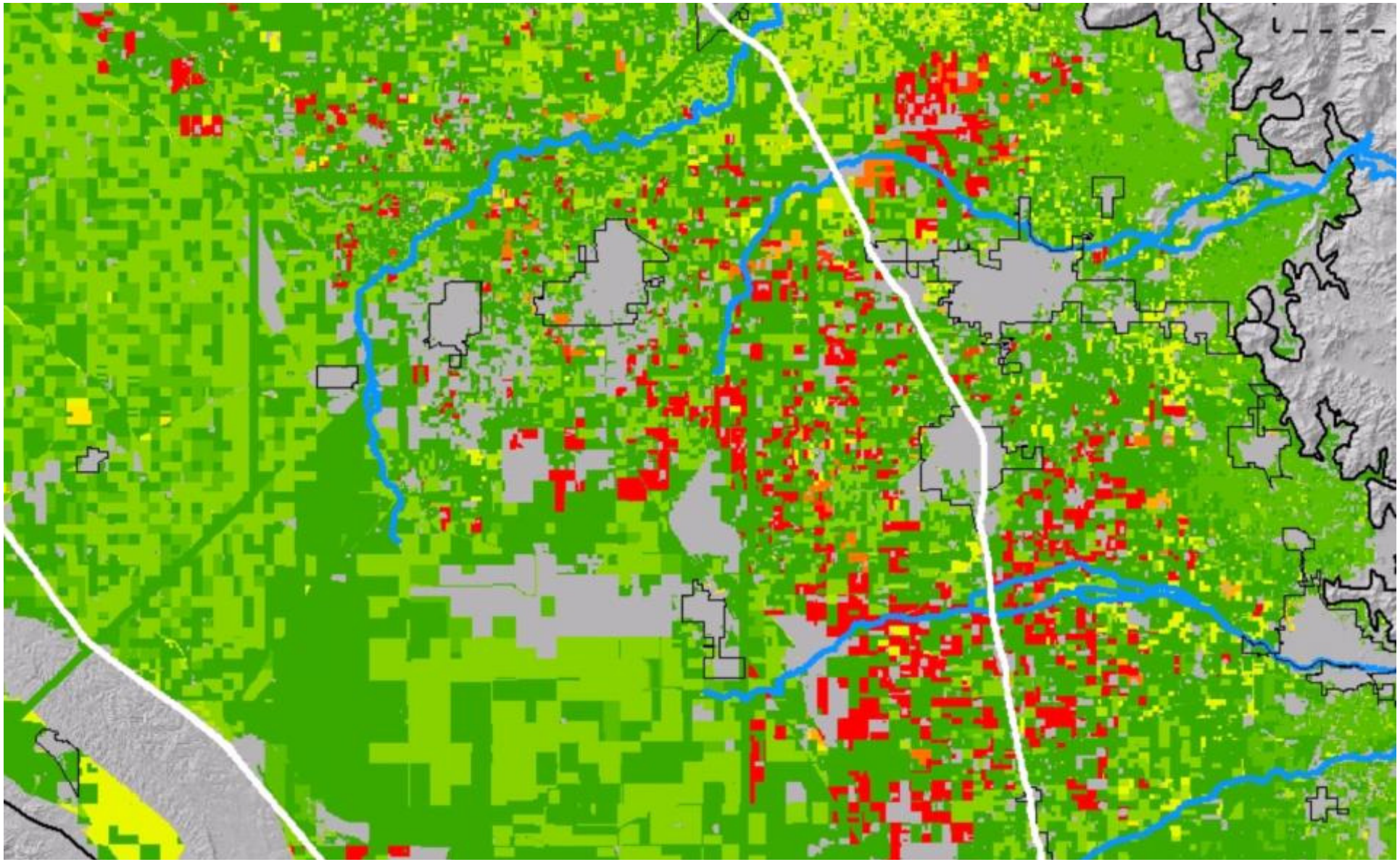
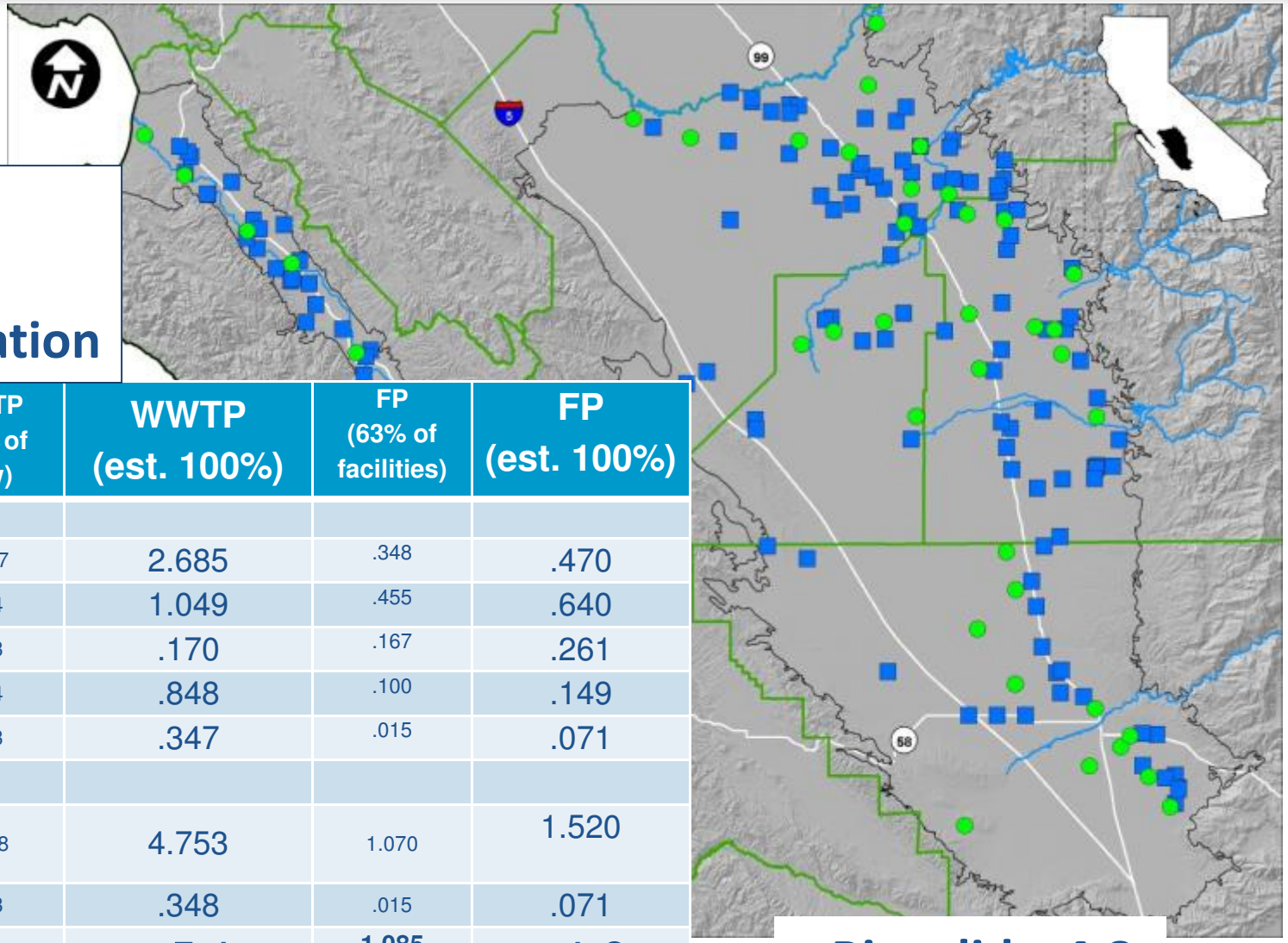


Wastewater Treatment Plants (BLUE) and Food Processors (GREEN)



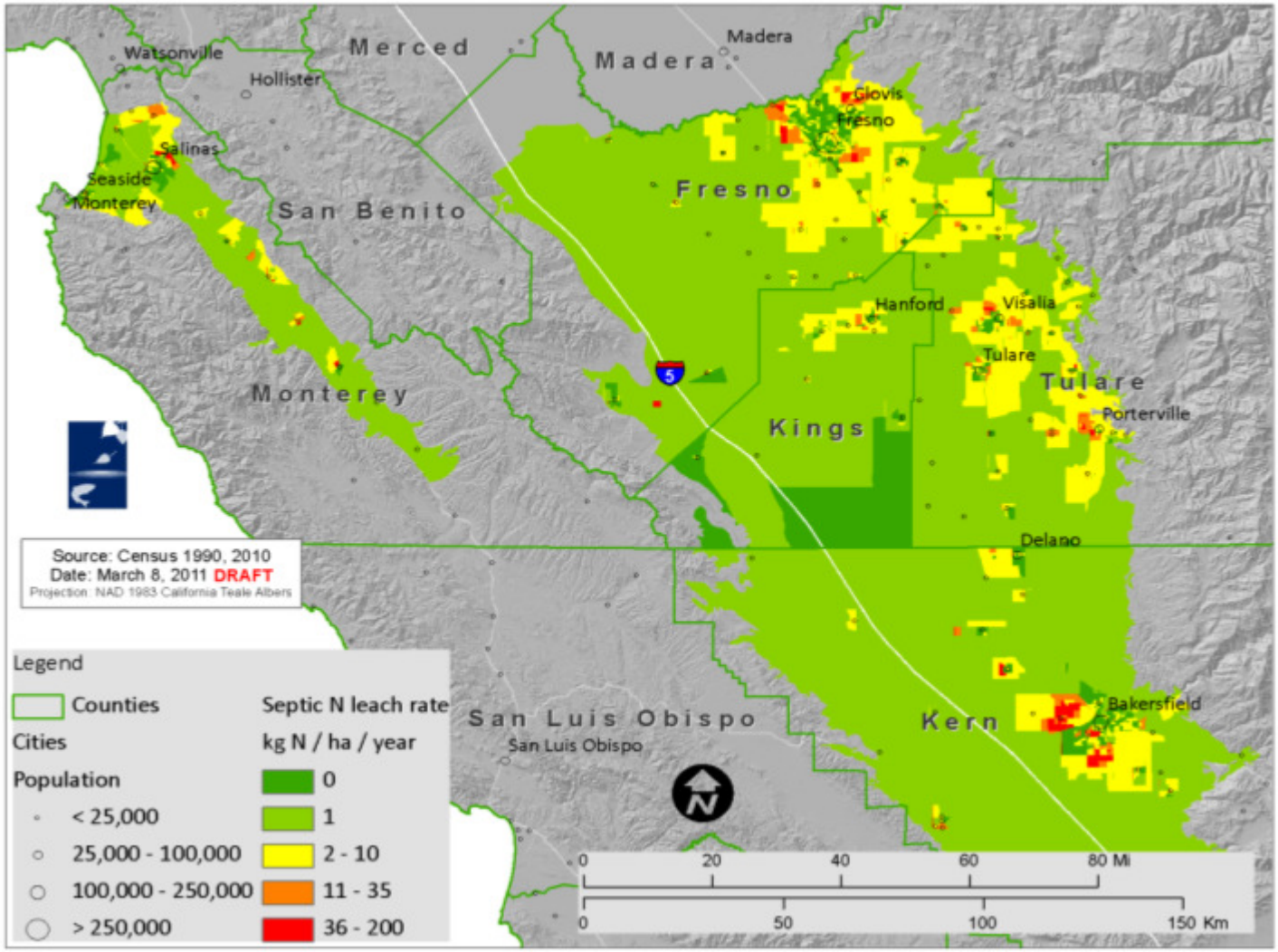
Gg N/Year to percolation or land application

	WWTP (90% of flow)	WWTP (est. 100%)	FP (63% of facilities)	FP (est. 100%)
By County				
Fresno	2.417	2.685	.348	.470
Kern	.944	1.049	.455	.640
Kings	.153	.170	.167	.261
Tulare	.764	.848	.100	.149
Monterey	.313	.347	.015	.071
By Basin				
Tulare Lake Basin	4.278	4.753	1.070	1.520
Salinas Valley	.313	.348	.015	.071
Total	**4.591**	**~5.1**	**1.085**	**~1.6**

+ Biosolids: 4.8

Septic Systems

Septic N Leached Directly to GW: 2.3 Gg N/yr



Key Findings

- Groundwater loading from crops is large: synthetic fertilizer and manure are key source
- Other sources locally relevant
- Best available data
- Future monitoring needs