The changing agricultural landscape

- “Green Revolution” resulted in substantial changes in agriculture
- Yields have increased 2% per acre each year since 1948
  - Corn: 38.5 to 118 bushels/acre/year from 1930 to 1985
  - Wheat: 16.7 to 37.5 bushels/acre/year
  - Milk: 5,314 to 13,786 lbs/cow/year

Increased production has occurred with shrinking labor force

- In 1930, 30% of U.S. population was involved in food production....
  - in 1950, 17%
  - in 1995, 2%

Increased production is a result of:

- Improved understanding of animal husbandry & farming
- Substantial increases in the use of fertilizers
- Substantial increases in the use of pesticides
- Reliance on monocultures
**Fertilizers:**

- Three principle plant nutrients:
  - Nitrogen
  - Phosphorus
  - Potassium

- Total U.S. use of fertilizers increased from:
  - 8 million tons in 1960
  - to over 19 million tons in 1990

**How farmers maintain Nitrogen (N):**

- Historically, crop rotation
- Currently, N applications
  - Corn applications have increased from 57 to 110 lbs/acre from 1960 to 1990

**Pesticides:**

Total pounds of pesticide active ingredients in U.S. farms have increased 170% from 1965 to 1985

**Farmers have specialized to maximize their productivity:**

- Historically, farms were small and diverse, creating a heterogeneous landscape.
- Today, most farms are large monocultures.
Number and size of farms:

- Number of U.S. farms has declined from 5.9 to 2.0 million, 1945 to 1990
- Total acres harvested has remained constant at about 340 million acres
- Average farm has tripled in size

Cultural as well as biological consequences

There are two spiritual dangers in not owning a farm. One is the danger of supposing that food comes from the grocery, and the other that heat comes from the furnace.

To live, we must daily break the body and shed the blood of Creation. When we do this knowingly, lovingly, skillfully, reverently, it is a sacrament.

Wendell Berry, 1981

Impacts of agriculture on wildlife:

- Negative effects:
  - Direct habitat loss
  - Habitat fragmentation
  - Habitat degradation
  - Ecological shifts
  - Poisoning

Habitat loss:

- Slash and burn agriculture
- the primary immediate cause of topical deforestation is agriculture (esp. cattle production)
- Mangrove forests
- mangrove forests are one of the most imperiled habitats on earth, and they are increasingly lost for conversion to shrimp farms
- US Native grasslands
- tall-grass prairie has been reduced to less than 2% of its original extent
- short-grass prairie is reduced to 18% of its historic range
- both prairie reductions are the result primarily of agriculture, especially grain crops
- Wetlands
- many wetlands have been drained for agricultural use (e.g., prairie pothole region, California’s Central Valley has only 3% of its original valley riparian forests)
- however, some wetland agricultural systems (e.g., rice cultivation) can be well integrated with waterfowl management
- Eastern deciduous forests
- agricultural area has risen and fallen in last 200 years – recovery???
Physical disturbances in farms habitats are commonplace

- Plowing or discing at least once per year to rotate crops and reduce weeds
- Forage crops usually mowed or hayed at least twice per year
- Nest destruction and/or direct mortality of adult wildlife often result – ecological traps

Agricultural effects on water quality, a few points

- Agriculture is the largest nonpoint source of water pollution, accounting for up to 50% of all contaminated water
- Water from irrigation and precipitation leaves agricultural areas carrying:
  - Sediments
  - Nutrients
  - Pesticide residues

Sediments, Nutrients, Pesticides……

- More sediment = less clarity; reduced aquatic vegetation
  - Florida Bay sugar-cane run-off
- More nutrients = algal blooms; decay, and O₂ depletion
  - Salton Sea

Sediments, Nutrients, Pesticides……

- Mineralization & salinization can increase selenium concentrations and waterfowl die-offs
  - Kesterson Wildlife Refuge
Sediments, Nutrients, Pesticides……

- Pesticides residues have caused declines in wildlife populations, especially fish-eating birds.
  - DDT banned in 1972
  - but still produced in U.S. and used in other countries
  - Parathion, Fenthion, and others continue to kill wildlife

Field borders

- Planting or maintaining permanent vegetation on field borders
  - enhanced vertical and horizontal habitat diversity
  - nesting cover for small birds & mammals
  - can reduce soil erosion and improve water quality

Food plots

- Leave or plant 3-10 meters of grain crops along field borders to provide food for wildlife

Integrating wildlife and agriculture successfully

Five ways, by creating and/or maintaining:

1. Field borders
2. Food plots
3. Shelterbelts
4. Fencerows and “odd areas”
5. Alternative cultivation practices
Fencerows, shelterbelts, and “odd areas”

Alternative cultivation practices

- Multi-cropping
- Organics
- Community supported agriculture

Do these systems support more wildlife?

Alternative cultivation practices

Conventional tillage

Conservation tillage

- leave previous year’s crop residue behind
- good for soil, but do these practices affect wildlife directly?
Timing modifications

Subtle changes in ag. practice timing can have big effects on wildlife
- Killdeer nest mid-March through mid-April (first brood; and even into May and June for later broods). Minimizing disturbance during this period can allow successful fledging
- Mourning dove nest cycle is 28 days; farmers who enter their fields at intervals greater than this will allow some nests to be successful

Farm programs

Conservation Reserve Program (CRP)
- Passed in 1985 under Federal Food Security Act (the “Farm Bill.”)
- Farmers get paid to plant permanent cover crops (sometime native species) on erodible land for 10 years.
- By nearly all accounts, this program has benefited soil and wildlife...and most farmers.

Alternative cultivation practices

Organic farming
- Few to no agrochemicals
- More edges & smaller farms

Integrating wildlife and agriculture successfully

Average size of farms (2002 census):
- US = 441 acres
- California = 346 acres

Percent of farms family-owned:
- California = 31%
- Humboldt County = 88%

Percent of farms applying “significant” agrochemicals:
- US = 60%
- California = 59%
- Humboldt County = 19%