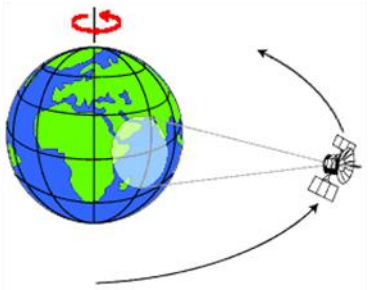
NICHOLAS SCHOOL OF THE ENVIRONMENT AND EARTH SCIENCES
DUKE UNIVERSITY

Databases/SQL: Tutorial 3

ENV 859 – Advanced GIS

Section 6 – Tutorial 1



Fay 2012

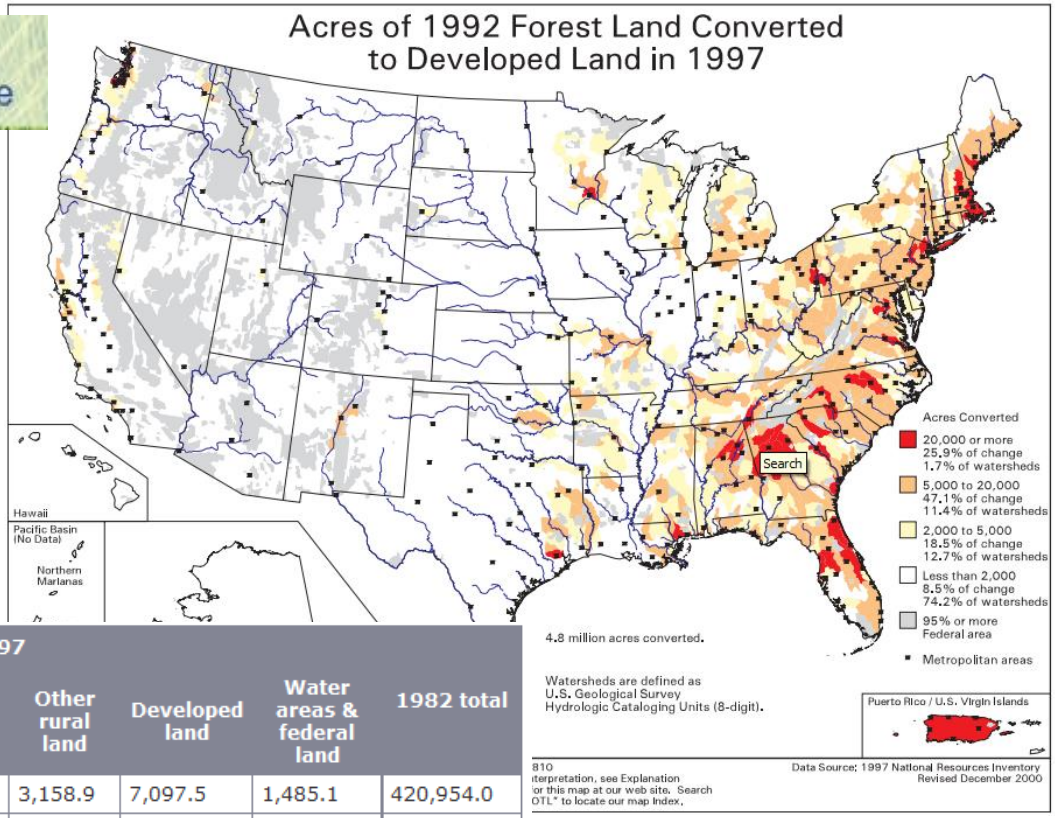
Overview

- Schemas
  - What are they?
  - Importing data into a schema
- Database relationships
- Aggregate functions
- Transforming data/Crosstab queries

The NRI database

USDA United States Department of Agriculture
Natural Resources Conservation Service

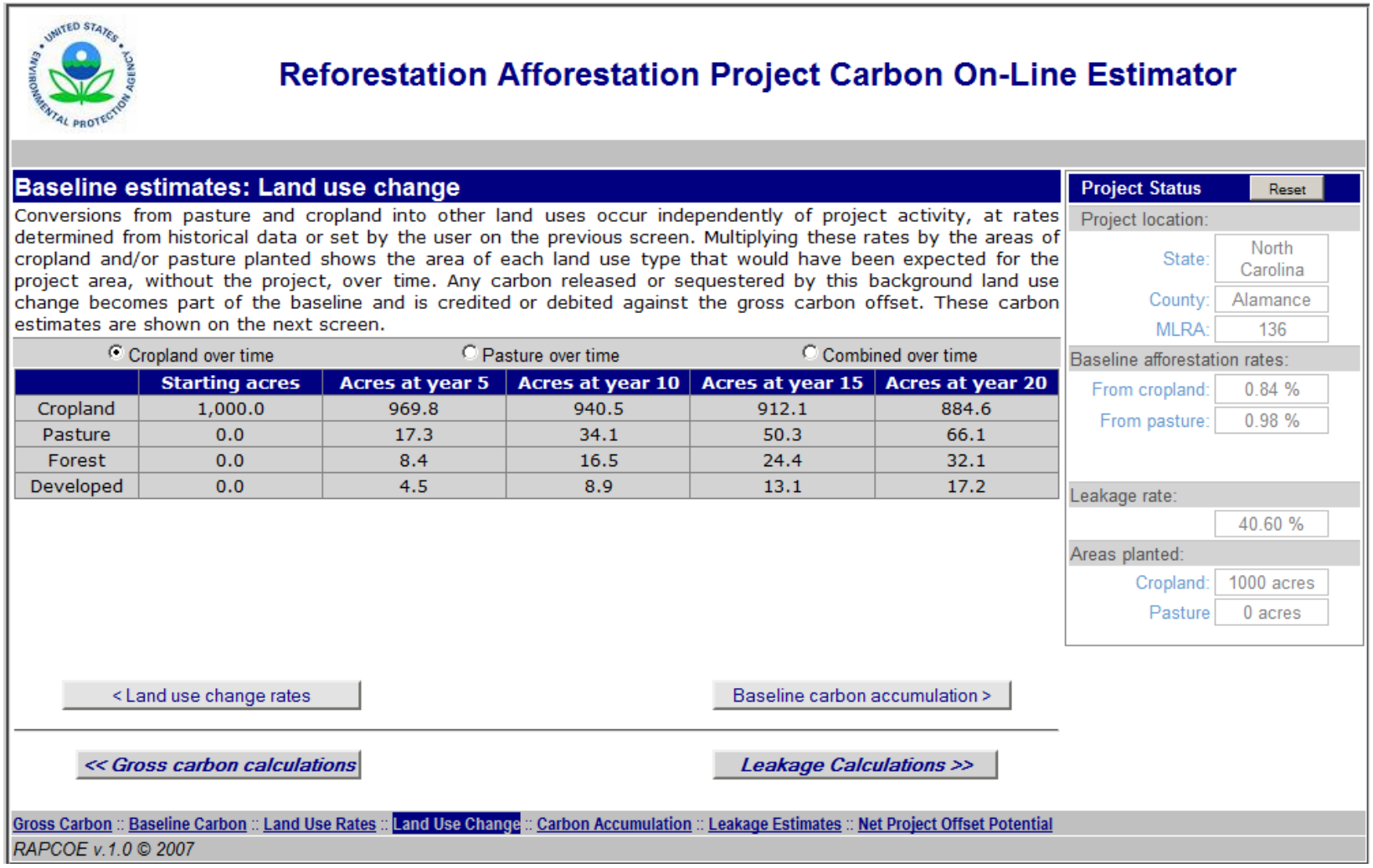
National
Resources
Inventory



Land cover/use in 1997									
Land cover/use in 1982	Cropland	CRP land	Pasture-land	Rangeland	Forest land	Other rural land	Developed land	Water areas & federal land	1982 total
Cropland	350,265.3	30,412.1	19,269.4	3,659.2	5,606.5	3,158.9	7,097.5	1,485.1	420,954.0
Pastureland	15,347.0	1,329.6	92,088.3	2,567.9	14,091.4	1,619.0	4,230.0	732.8	132,006.0
Rangeland	6,967.5	728.5	3,037.2	394,617.4	3,021.6	1,702.7	3,281.3	3,383.2	416,739.4
Forest land	2,037.1	128.8	4,168.2	2,098.8	380,343.3	1,754.8	10,279.2	2,528.0	403,338.2
Other rural land	1,386.8	93.1	1,013.6	719.1	2,767.7	42,713.3	726.9	227.8	49,648.3
Developed Land	196.7	1.2	78.6	110.8	227.0	12.0	72,618.7	0.8	73,245.8
Water areas federal land	797.5	2.7	336.6	2,204.0	897.7	180.8	18.1	443,760.6	448,198.0
1997 total	376,997.9	32,696.0	119,991.9	405,977.2	406,955.2	51,141.5	98,251.7	452,118.3	1,944,129.7

NRI in RAPCOE

http://ecoserver.env.duke.edu/RAPCOEV1



Reforestation Afforestation Project Carbon On-Line Estimator

Baseline estimates: Land use change

Conversions from pasture and cropland into other land uses occur independently of project activity, at rates determined from historical data or set by the user on the previous screen. Multiplying these rates by the areas of cropland and/or pasture planted shows the area of each land use type that would have been expected for the project area, without the project, over time. Any carbon released or sequestered by this background land use change becomes part of the baseline and is credited or debited against the gross carbon offset. These carbon estimates are shown on the next screen.

(•) Cropland over time ( ) Pasture over time ( ) Combined over time

	Starting acres	Acres at year 5	Acres at year 10	Acres at year 15	Acres at year 20
Cropland	1,000.0	969.8	940.5	912.1	884.6
Pasture	0.0	17.3	34.1	50.3	66.1
Forest	0.0	8.4	16.5	24.4	32.1
Developed	0.0	4.5	8.9	13.1	17.2

Project Status Reset

Project location:
State: North Carolina
County: Alamance
MLRA: 136

Baseline afforestation rates:
From cropland: 0.84 %
From pasture: 0.98 %

Leakage rate:
40.60 %

Areas planted:
Cropland: 1000 acres
Pasture 0 acres

< Land use change rates | Baseline carbon accumulation >

<< Gross carbon calculations | Leakage Calculations >>

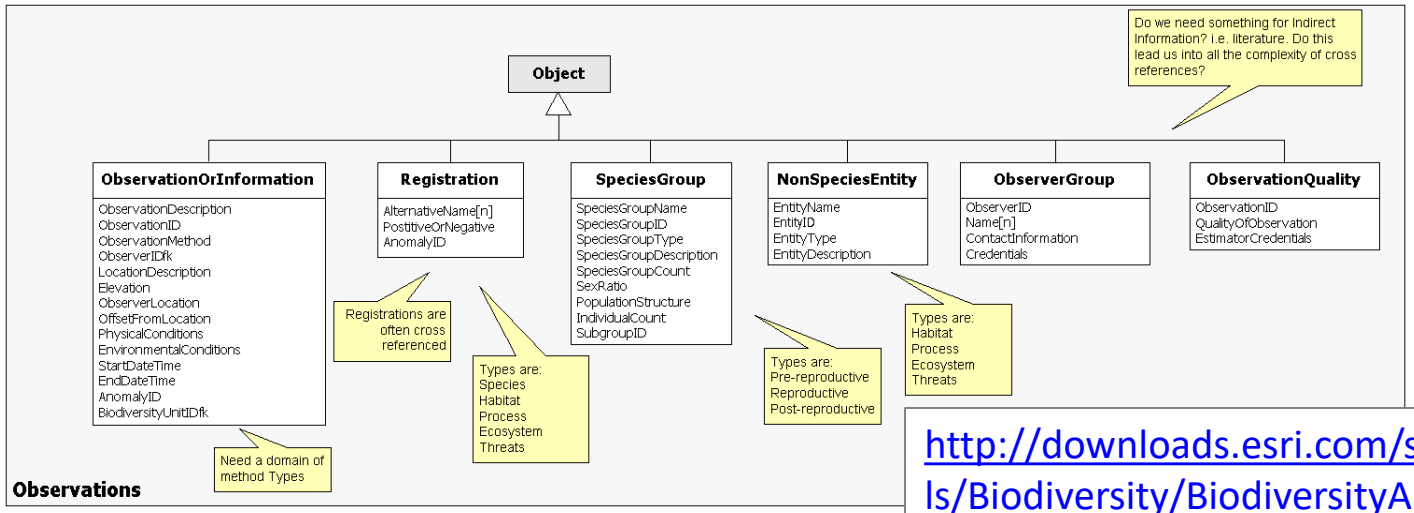
Gross Carbon :: Baseline Carbon :: Land Use Rates :: Land Use Change :: Carbon Accumulation :: Leakage Estimates :: Net Project Offset Potential

RAPCOE v.1.0 © 2007

Database schemas/database models

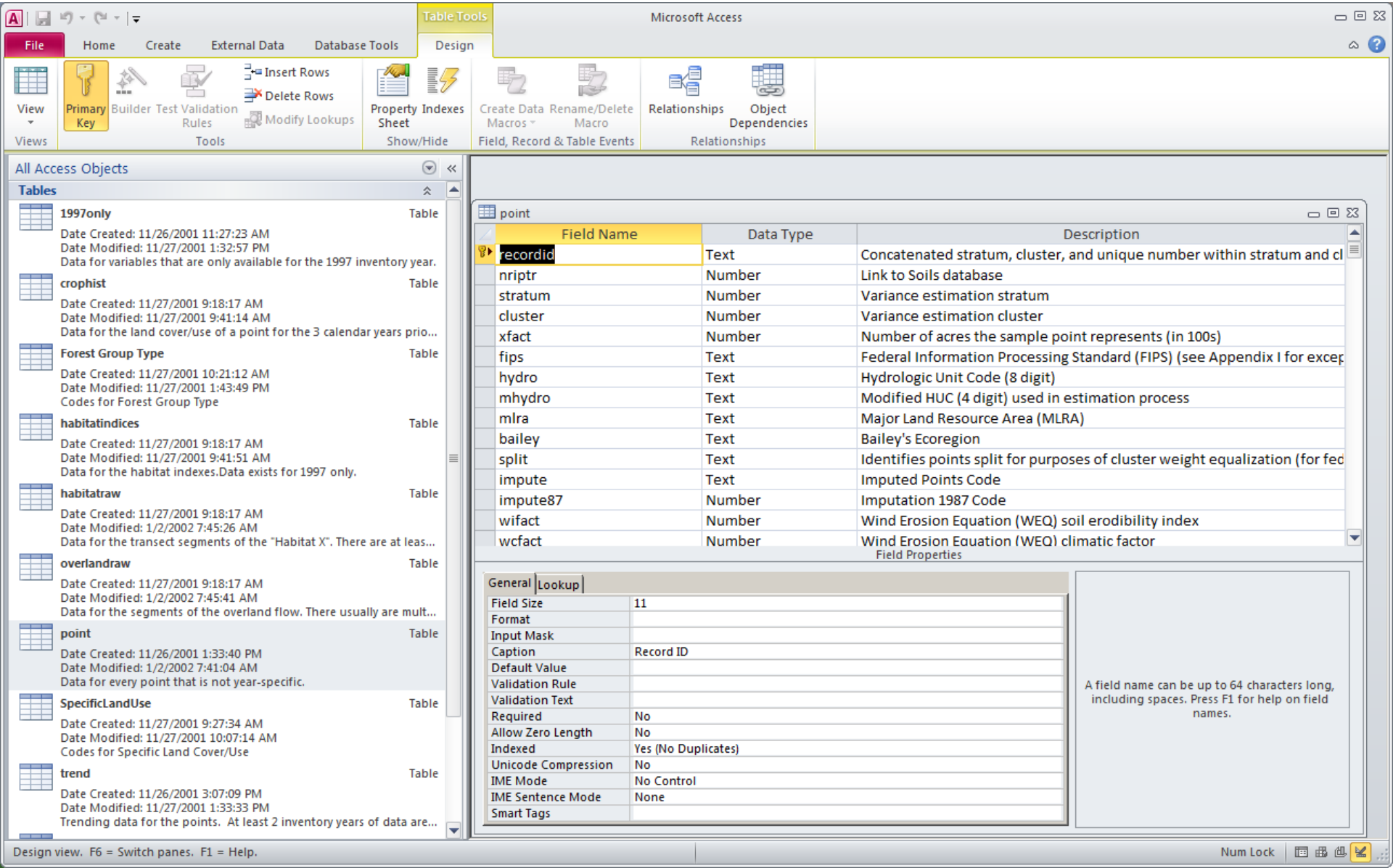
- Address
- Agriculture
- Atmospheric
- Basemap
- **Biodiversity**
- BroadbandStat
- Building Interior Space
- Carbon Footprint
- Census-Administrative Boundaries
- Defense-Intel
- Energy Utilities (includes ArcGIS MultiSpeak)
- Environmental Regulated Facilities
- Fire Service
- Forest Service
- Forestry
- Geology
- GIS for the Nation
- Groundwater
- Health
- Historic Preservation and Archaeology
- Homeland Security
- Hydro
- International Hydrographic Organization (IHO) S-57 for ENC
- Irrigation
- Land Parcels
- Local Government
- **Marine**
- National Cadastre
- Petroleum
- Pipeline
- Raster
- Telecommunications
- Transportation
- Water Utilities

ESRI Database Models
http://support.esri.com/en/downloads/datamodel/

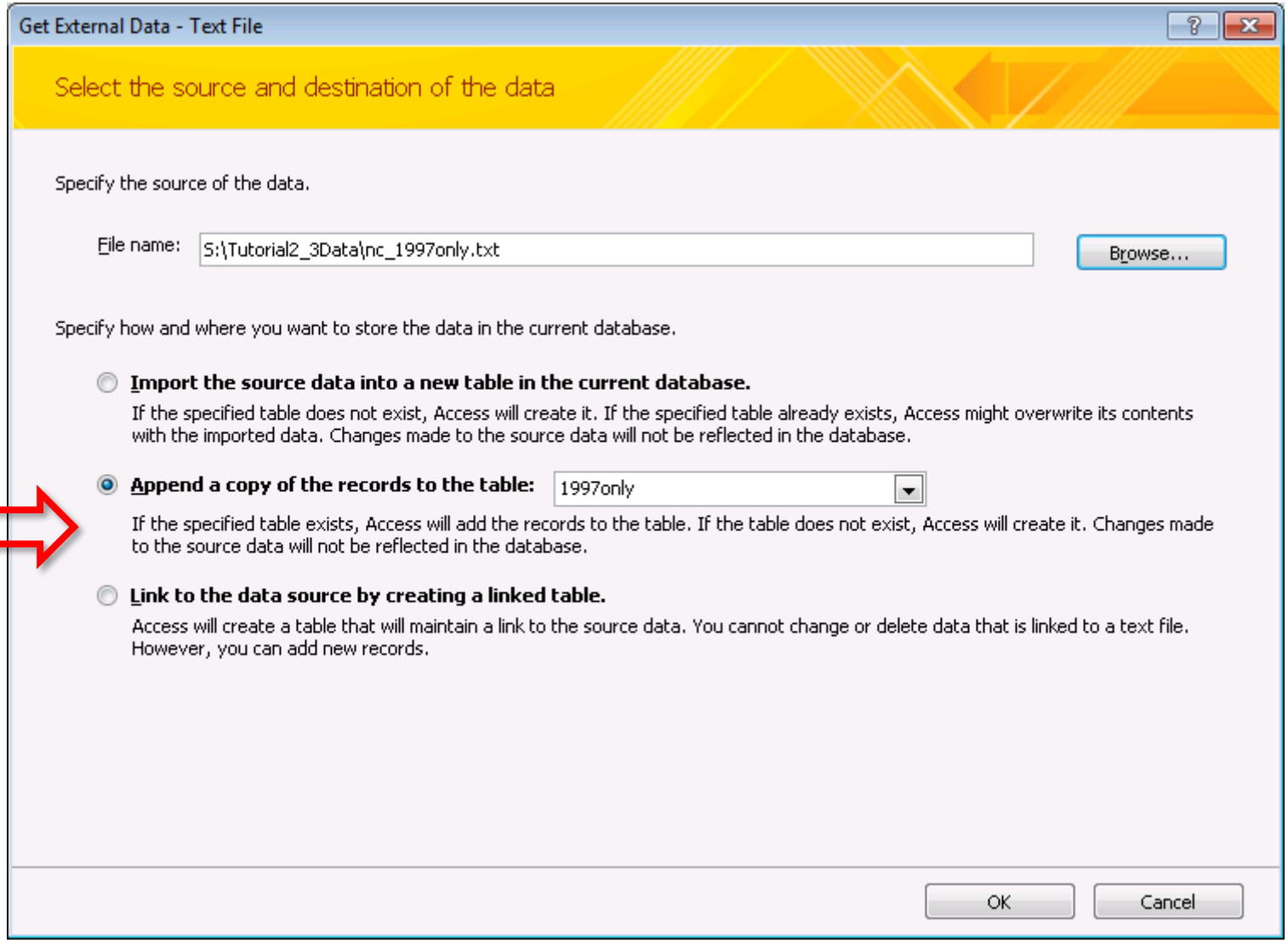


http://downloads.esri.com/support/datamodels/Biodiversity/BiodiversityAnalysis.gif

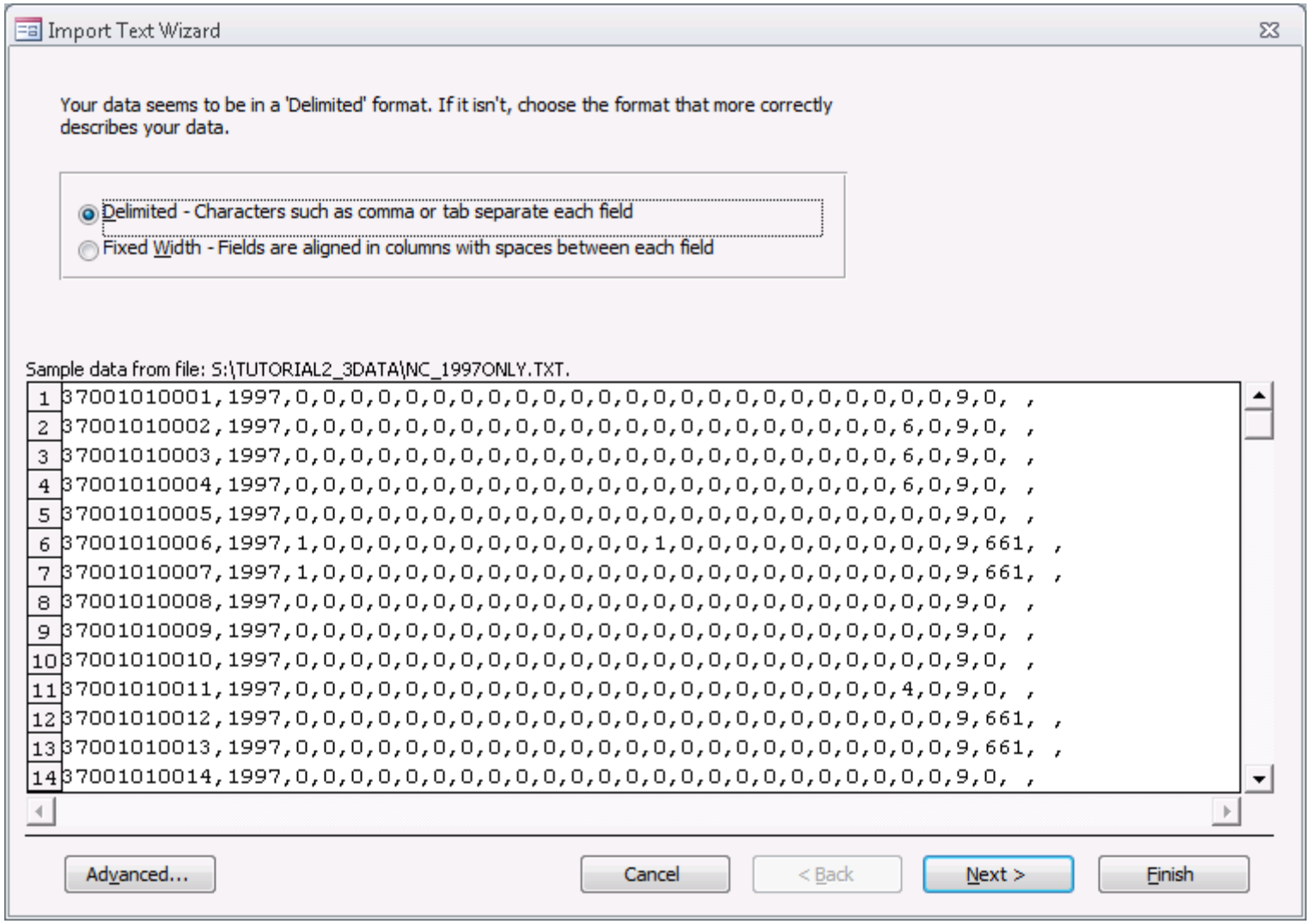
The NRI1997 schema



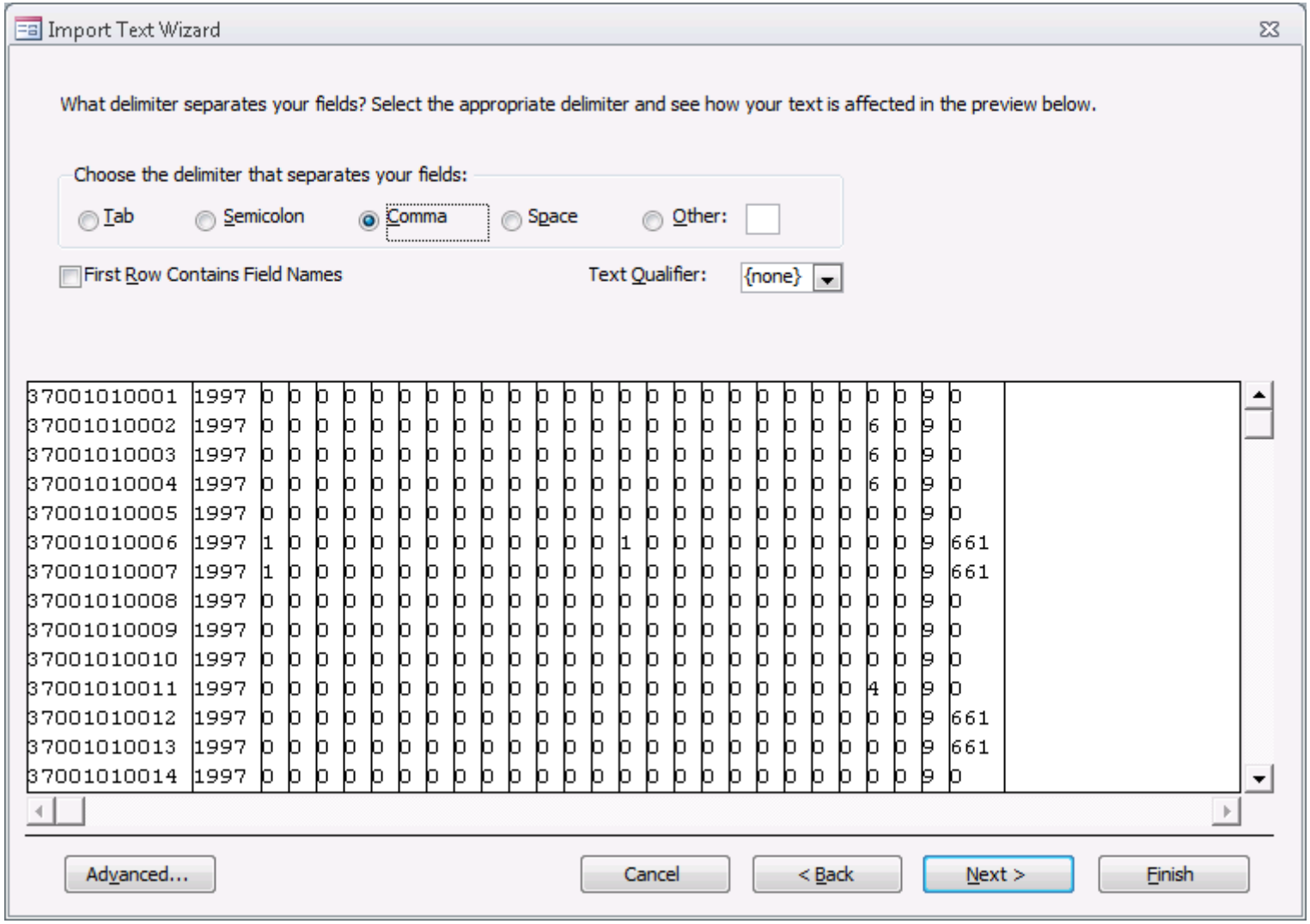
Using the NRI schema



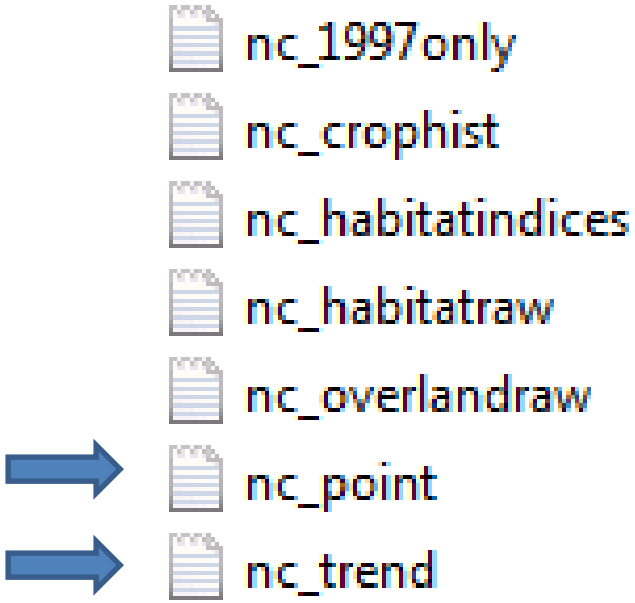
Using the NRI schema



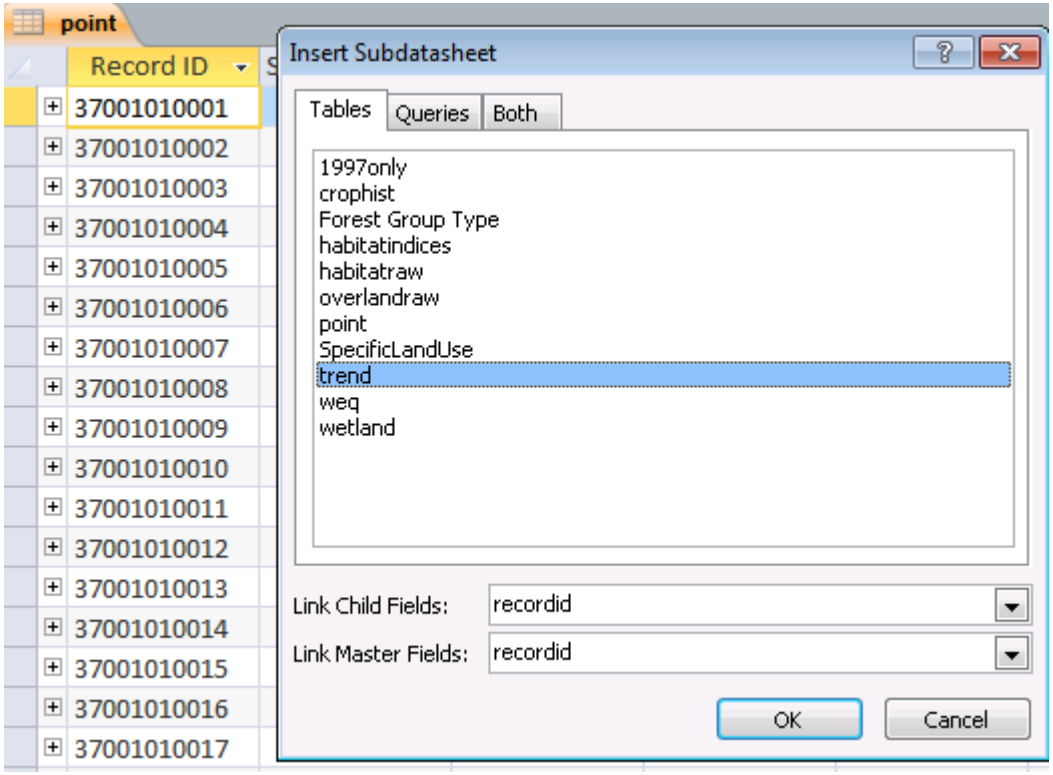
Using the NRI schema

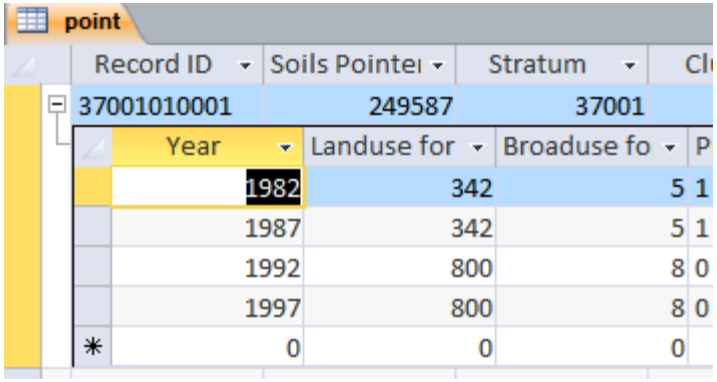


Using the NRI schema

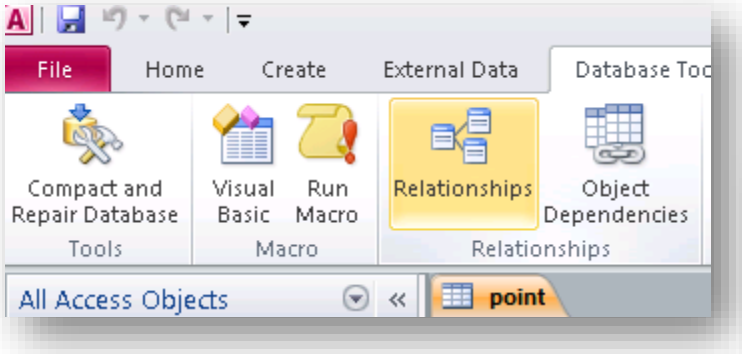


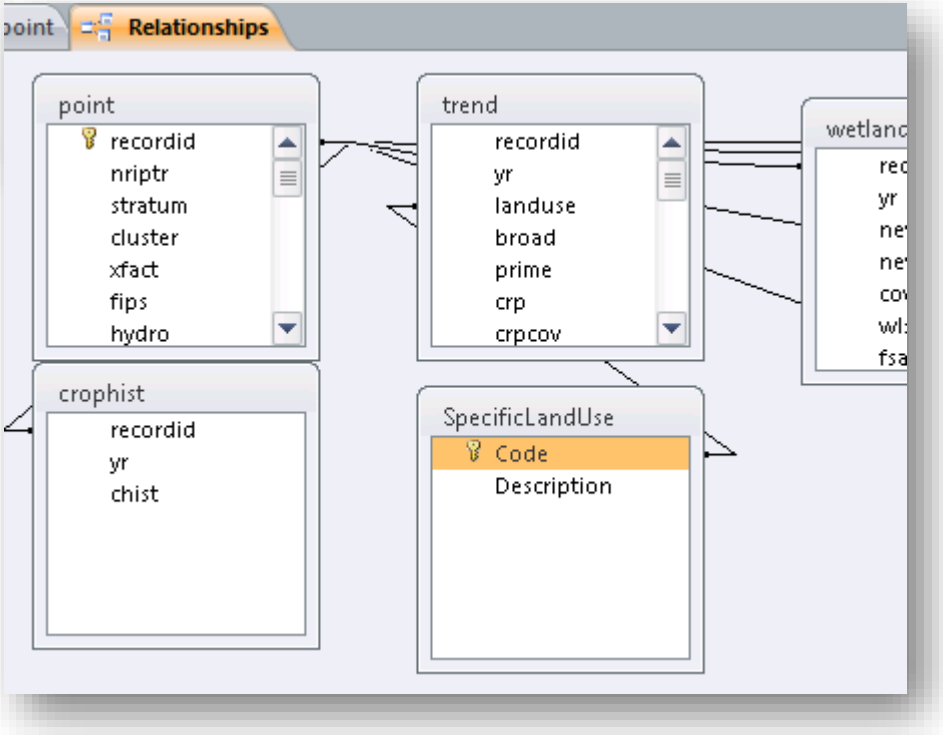
Database relationships

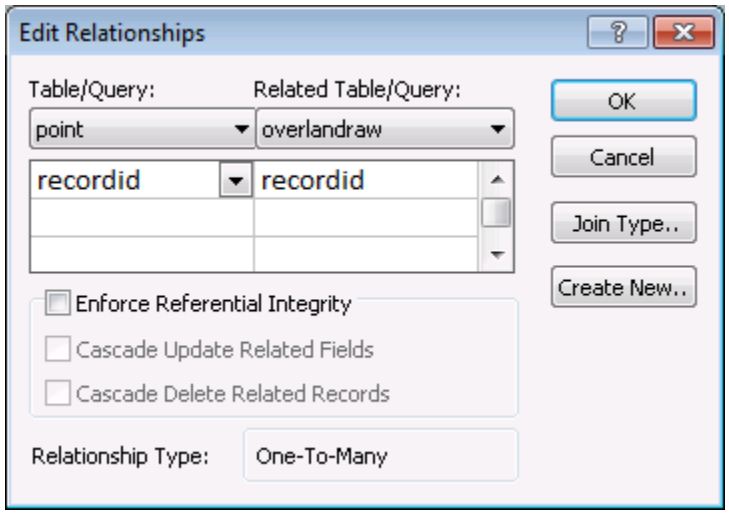




Database relationships



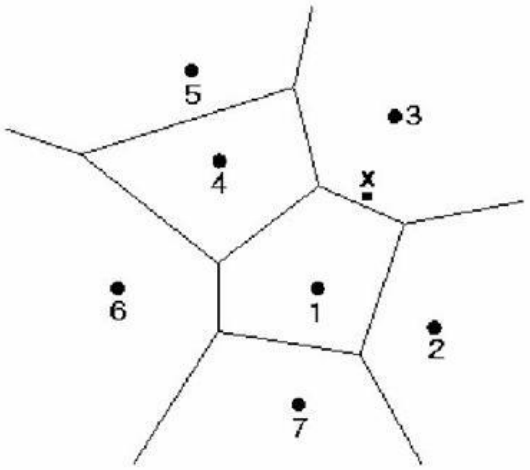




Aggregating functions

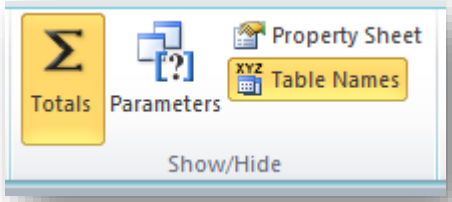
Record ID	Soils Pointer	Stratum	Cluster	Expansion Facto	FIPS code
37001010001	249587	37001	1	1	37001
37001010002	288554	37001	1	17	37001
37001010003	274351	37001	1	17	37001
37001010004	274167	37001	1	17	37001
37001010005	288554	37001	1	1	37001
37001010006	249587	37001	1	25	37001
37001010007	274175	37001	1	26	37001
37001010008	249587	37001	1	1	37001
37001010009	215428	37001	1	1	37001
37001010010	250974	37001	1	1	37001
37001010011	249110	37001	1	15	37001
37001010012	216529	37001	1	16	37001
37001010013	250968	37001	1	15	37001

point table



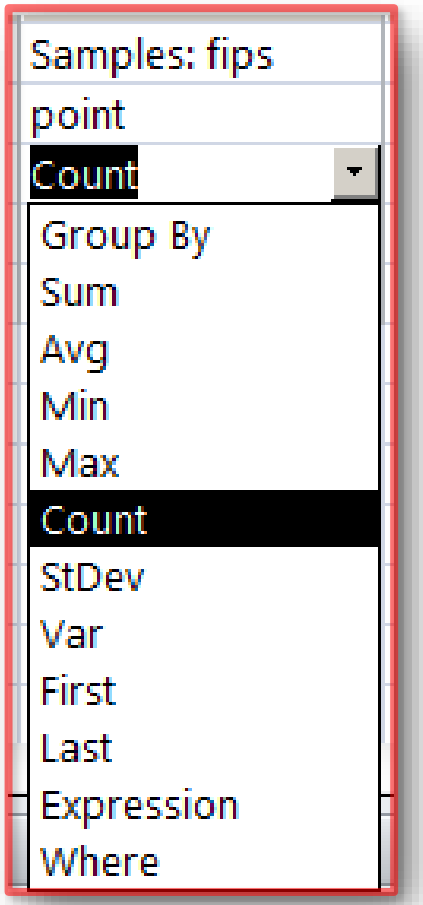
FIPS code	Samples	Acres
37001	369	278300
37003	191	168500
37005	314	150700
37007	336	343800
37009	445	273200
37011	188	158200
37013	386	613600
37015	279	474400

Aggregate functions



Field:	fips	fips	xfact
Table:	point	point	point
Total:	Group By	Count	Sum
Sort:			
Show:	☑	☑	☑
Criteria:			
or:			

Field:	fips	Samples: fips	Acres: [xfact]*100
Table:	point	point	
Total:	Group By	Count	Sum



Aggregating functions

```
SELECT point.fips, Count(point.fips) AS Samples,
Sum([xfact]*100) AS Acres
FROM point
GROUP BY point.fips;
```

FIPS code	Samples	Acres
37001	369	278300
37003	191	168500
37005	314	150700
37007	336	343800
37009	445	273200
37011	188	158200
37013	386	613600
37015	279	474400
37017	350	567800

```
SELECT point.fips, Count(point.fips) AS Samples,
Sum([xfact]*100) AS Acres
FROM point
WHERE flood = 'FREQ'
GROUP BY point.fips;
```

FIPS code	Samples	Acres
37003	13	8100
37005	3	1700
37007	51	24900
37009	10	10100
37011	3	2300
37013	15	36600
37015	62	139600
37017	19	43700

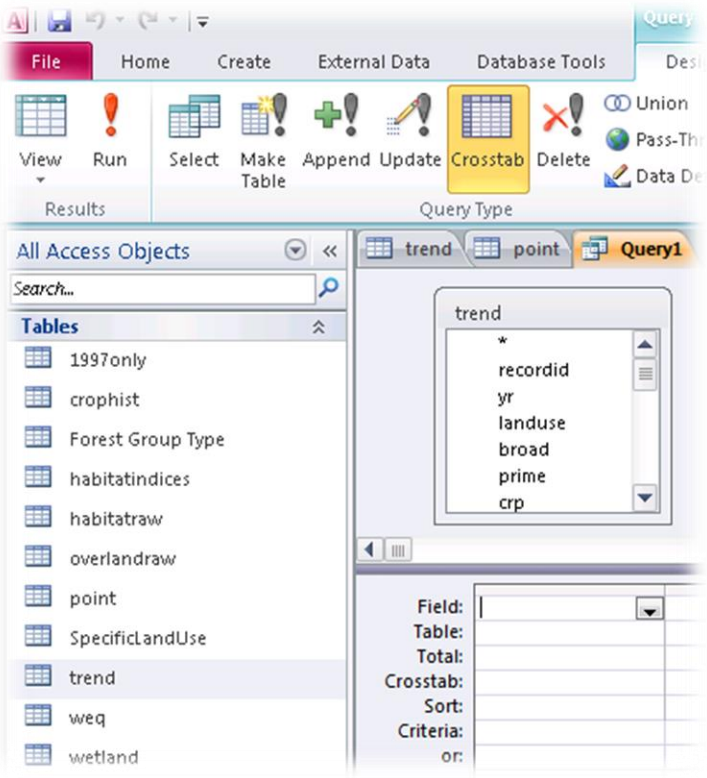
Transforming Data: Crosstab Queries

Record ID	Year	Landuse for 1982, 1987, 1992, 1997	Broaduse for 1982, 1987, 1992, 1997
37001010001	1982	342	5
37001010001	1987	342	5
37001010001	1992	800	8
37001010001	1997	800	8
37001010002	1982	342	5
37001010002	1987	342	5
37001010002	1992	342	5
37001010002	1997	342	5

Record ID	1982	1987	1992	1997
37001010001	5	5	8	8
37001010002	5	5	5	5
37001010003	5	5	5	5
37001010004	5	5	5	5
37001010005	5	5	5	8

Record ID	1982	1987	1992	1997
37001010001	Forest land	Forest land	Rural transport	Rural transport
37001010002	Forest land	Forest land	Forest land	Forest land
37001010003	Forest land	Forest land	Forest land	Forest land
37001010004	Forest land	Forest land	Forest land	Forest land
37001010005	Forest land	Forest land	Forest land	Rural transport

Transforming Data: Crosstab Queries



Field:	recordid	yr	broad
Table:	trend	trend	trend
Total:	Group By	Group By	First
Crosstab:	Row Heading	Column Heading	Value
Sort:			
Criteria:			
or:			

Values →
Row headings →
Column headings →

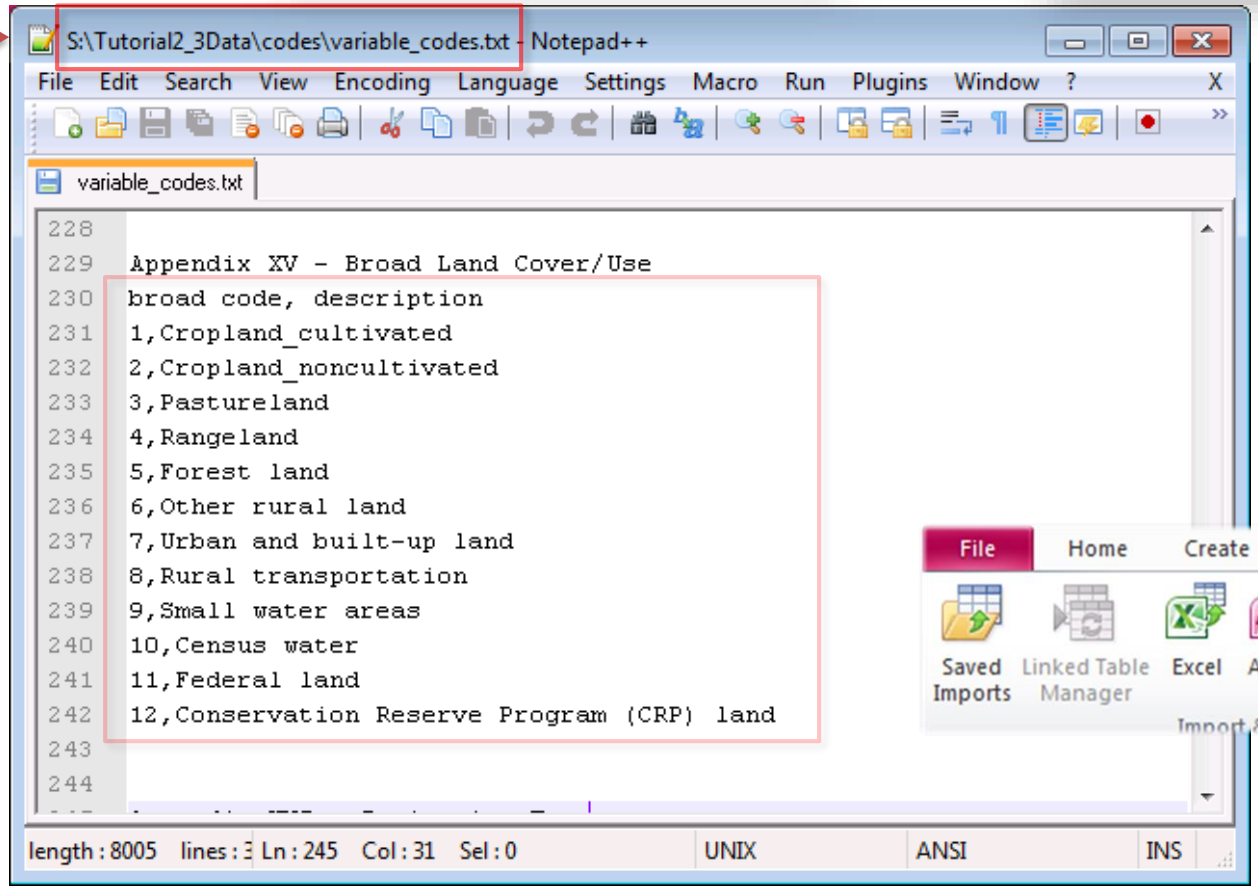
```
TRANSFORM First(trend.broad) AS FirstOfbroad
SELECT trend.recordid
FROM trend
GROUP BY trend.recordid
PIVOT trend.yr;
```

Transforming Data: Crosstab Queries

Adding the Broad Land Use categories

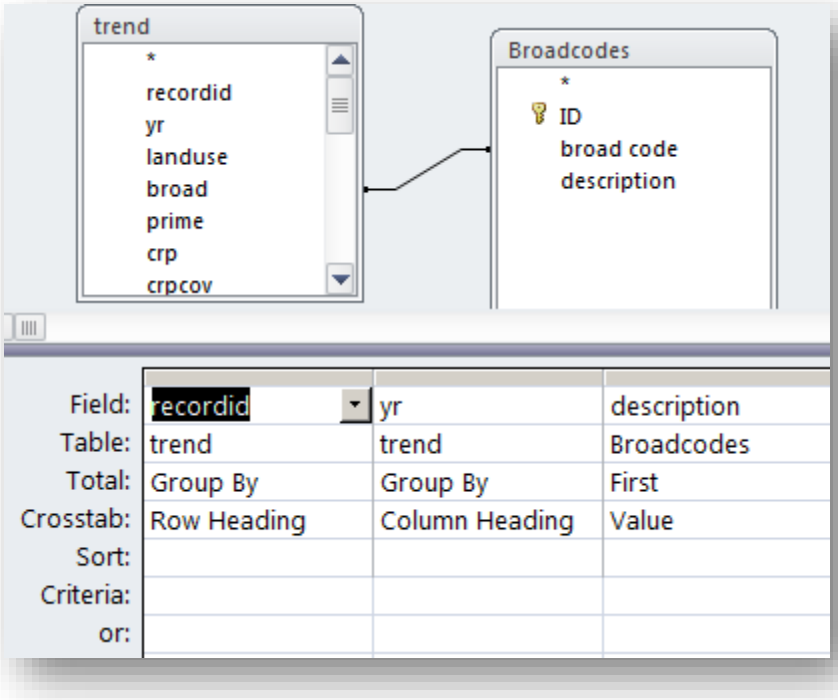
Record ID	1982	1987
37001010001	5	5
37001010002	5	5
37001010003	5	5
37001010004	5	5
37001010005	5	5

Record ID	1982	1987
37001010001	Forest land	Forest land
37001010002	Forest land	Forest land
37001010003	Forest land	Forest land
37001010004	Forest land	Forest land
37001010005	Forest land	Forest land



Transforming Data: Crosstab Queries

Joining the Broad Land Use categories



Record ID	1982	1987	1992	1997
37001010001	5	5	8	8
37001010002	5	5	5	5
37001010003	5	5	5	5
37001010004	5	5	5	5
37001010005	5	5	5	8

Record ID	1982	1987	1992	1997
37001010001	Forest land	Forest land	Rural transport	Rural transport
37001010002	Forest land	Forest land	Forest land	Forest land
37001010003	Forest land	Forest land	Forest land	Forest land
37001010004	Forest land	Forest land	Forest land	Forest land
37001010005	Forest land	Forest land	Forest land	Rural transport

```
TRANSFORM First(Broadcodes.description) AS FirstOfdescription
SELECT trend.recordid
FROM trend INNER JOIN Broadcodes ON trend.broad = Broadcodes.[broad code]
GROUP BY trend.recordid
PIVOT trend.yr;
```

Task 1: *NC Land cover – 1982 to 1997*

1982

FIPS code	Acres	Census water	Cropland_cultivated	Cropland_noncultivated	Federal land	Forest land	Othe
37001	278300	1000	44900	2100		139000	
37003	168500	1800	24400	7100		83800	
37005	150700		2900	7900	7900	77100	
37007	343800	2900	82400	1500	8000	207300	
37009	273200		8400	13900	300	163800	
37011	158200			8000	19200	104400	
37013	613600	84400	126200		2800	322800	
37015	474400	23700	107300		100	319500	
37017	567800	5100	124700	2700		411400	
37019	571000	23400	44600	800	7500	438100	

1997

FIPS code	Acres	Census water	Conservation Re	Cropland_cultivated	Cropland_noncultivated	Federal land	Forest land	Oth
37001	278300	1000		37800	1900		126000	
37003	168500	1800		10700	3600		83900	
37005	150700			2100	1200	7900	78400	
37007	343800	2900	37300	29900	8500	8000	206200	
37009	273200			3200	7000	300	166300	
37011	158200				4300	29600	91900	
37013	613600	84400		117900		2800	324100	
37015	474400	23700		110000		6200	310100	
37017	567800	5100	5700	135700	5400		384800	
37019	571000	23400		31600		7500	416200	

Task 1: *NC Land cover – 1982 to 1997*

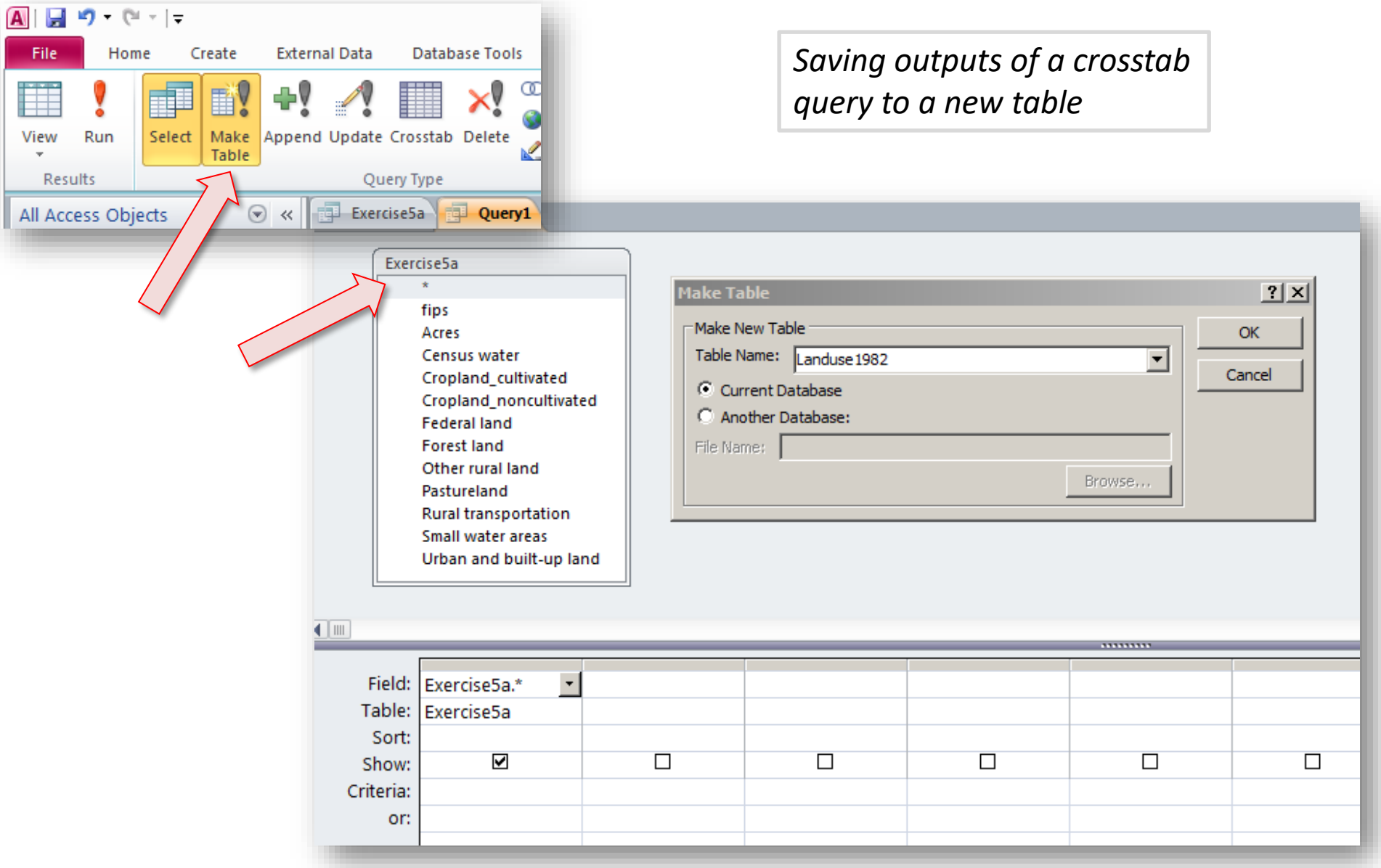
Field:	fips	description	Expr1: Sum([xfact]*100)	Acres: Sum([xfact]*100)	yr
Table:	point	Broadcodes			trend
Total:	Group By	Group By	Expression	Expression	Where
Crosstab:	Row Heading	Column Heading	Value	Row Heading	
Sort:					
Criteria:					1982
or:					

FIPS code	Acres	Census water	Cropland_cultivated	Cropland_noncultivated	Federal land	Forest land	Othe
37001	278300	1000	44900	2100		139000	
37003	168500	1800	24400	7100		83800	
37005	150700		2900	7900	7900	77100	
37007	343800	2900	82400	1500	8000	207300	
37009	273200		8400	13900	300	163800	
37011	158200			8000	19200	104400	
37013	613600	84400	126200		2800	322800	
37015	474400	23700	107300		100	319500	
37017	567800	5100	124700	2700		411400	
37019	571000	23400	44600	800	7500	438100	

```
TRANSFORM Sum([xfact]*100) AS Expr1
SELECT point.fips, Sum([xfact]*100) AS Acres
FROM point INNER JOIN (trend INNER JOIN Broadcodes ON trend.broad = Broadcodes.[broad code]) ON point.recordid
= trend.recordid
WHERE (((trend.yr)=1982))
GROUP BY point.fips
PIVOT Broadcodes.description;
```

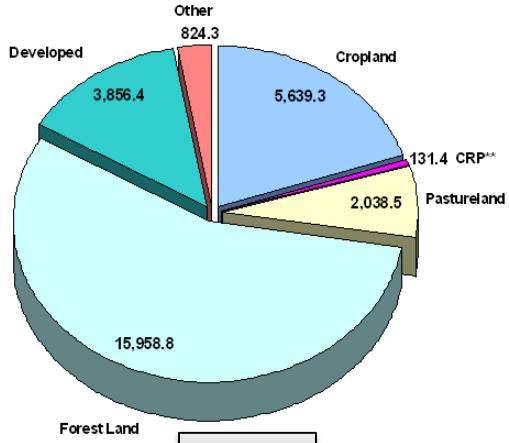
Task 1: *NC Land cover – 1982 to 1997*

Saving outputs of a crosstab query to a new table



Task 2: Fate of cropland from '82-'97

1982



1997

fips	TotalAcres	Census water	Conservation Reserv	Cropland_cultiv	Cropland_nonci	Federal land	Forest land	Other rural land	Pastureland	Rura
37003	31500			8300	3600		4100	700	10700	
37007	83900		37300	29700	6500		5300	100	4400	
37009	22300			3100	7000		2000	300	9000	

Of the **31,500** acres of cropland in Alexander Co. (*FIPS 37003*) seen in 1982, **4100** acres was classified as forest land in 1997…

Task 2: Fate of cropland from '82-'97

- Select records that were cropland in 1982…
- Cross-tabulate selected records on land use in 1997…

trend

Record ID	Year	Landuse for 1982, 1987, 1992, 1997	Broaduse for 1982, 1987, 1992, 1997
37001010001	1982	342	5
37001010001	1987	342	5
37001010001	1992	800	8
37001010001	1997	800	8

point

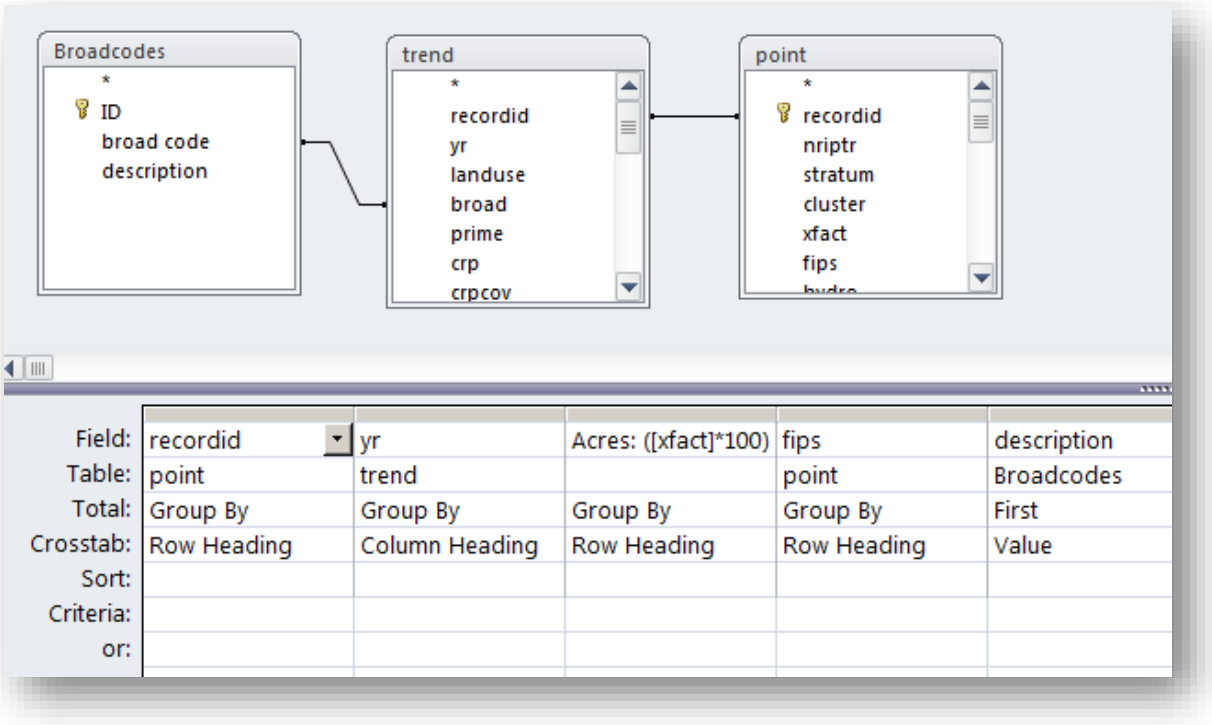
Record ID	Soils Pointer	Stratum	Cluster	Expansion Factor	FIPS code
37001010001	249587	37001	1	1	37001
37001010002	288554	37001	1	17	37001
37001010003	274351	37001	1	17	37001
37001010004	274167	37001	1	17	37001
37001010005	288554	37001	1	1	37001
37001010006	249587	37001	1	25	37001
37001010007	274175	37001	1	26	37001
37001010008	249587	37001	1	1	37001
37001010009	215428	37001	1	1	37001
37001010010	250974	37001	1	1	37001
37001010011	249110	37001	1	15	37001

Broadcodes

ID	broad code	description
1	1	Cropland_cultivated
2	2	Cropland_noncultivated
3	3	Pastureland
4	4	Rangeland
5	5	Forest land
6	6	Other rural land

Task 2: Fate of cropland from '82-'97

Step 1.

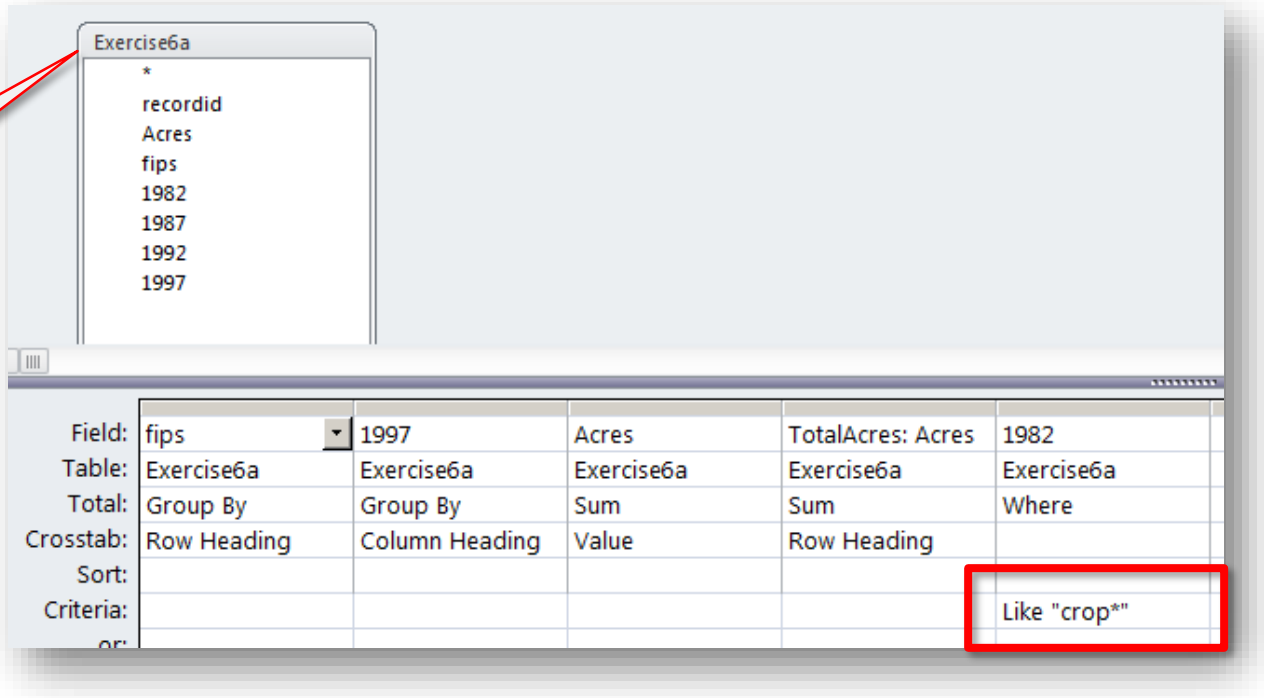


Record ID	Acres	FIPS code	1982	1987	1992	1997
37001010001	100	37001	Forest land	Forest land	Rural transportatio	Rural transportatio
37001010002	1700	37001	Forest land	Forest land	Forest land	Forest land
37001010003	1700	37001	Forest land	Forest land	Forest land	Forest land
37001010004	1700	37001	Forest land	Forest land	Forest land	Forest land
37001010005	100	37001	Forest land	Forest land	Forest land	Rural transportatio
37001010006	2500	37001	Cropland_cultivate	Cropland_cultivate	Cropland_cultivate	Cropland_cultivate
37001010007	2600	37001	Forest land	Forest land	Forest land	Cropland_cultivate
37001010008	100	37001	Other rural land	Other rural land	Other rural land	Other rural land

Task 2: Fate of cropland from '82-'97

Step 2.

From step 1

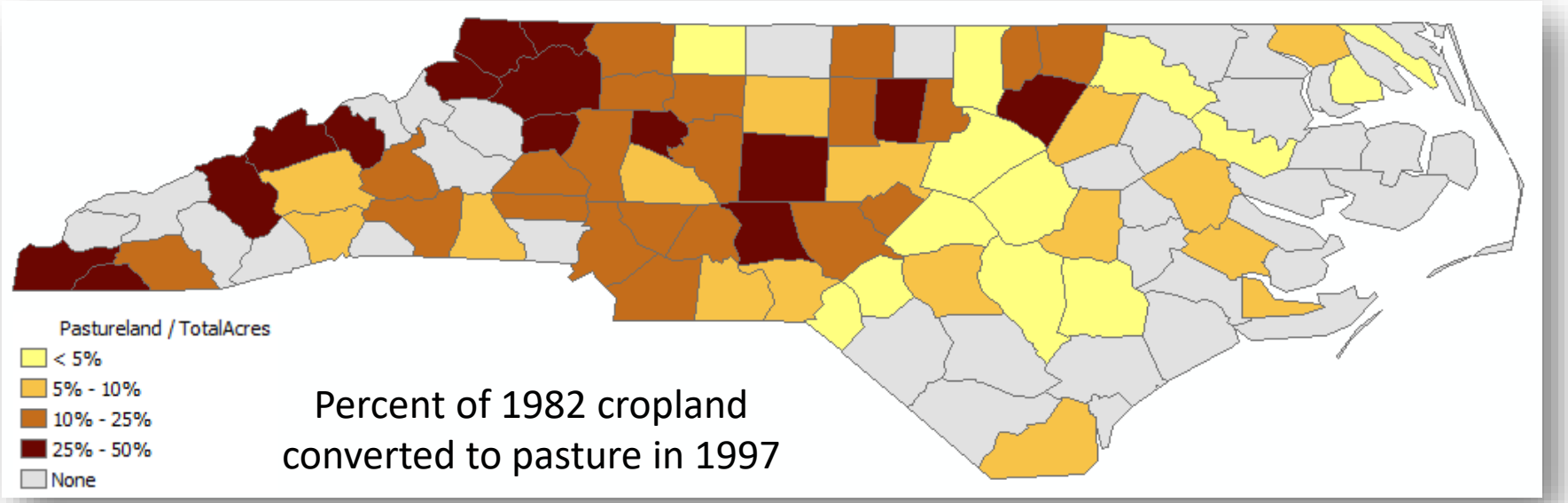


fips	TotalAcres	Census water	Conservation Reserv	Cropland_cultiv	Cropland_noncu	Federal land	Forest land	Other rural land	Pastureland	Rural
37001	47000			34900	1900			100	8500	
37003	31500			8300	3600		4100	700	10700	
37005	10800			1500	1200		1200	2200	4600	
37007	83900		37300	29700	6500		5300	100	4400	
37009	22300			3100	7000		2000	300	9000	

Viewing results in ArcMap

MS Access Crosstab query → Make table query → Table

ArcMap Open → Join to county features (FIPS) → Symbolize



Percent of 1982 cropland converted to pasture in 1997

QUESTIONS?