Coweeta Long Term Ecological Research

Land-use Legacies and the Future of Southern Appalachia

Ted Gragson – Coweeta LTER

LTER Symposium at NSF

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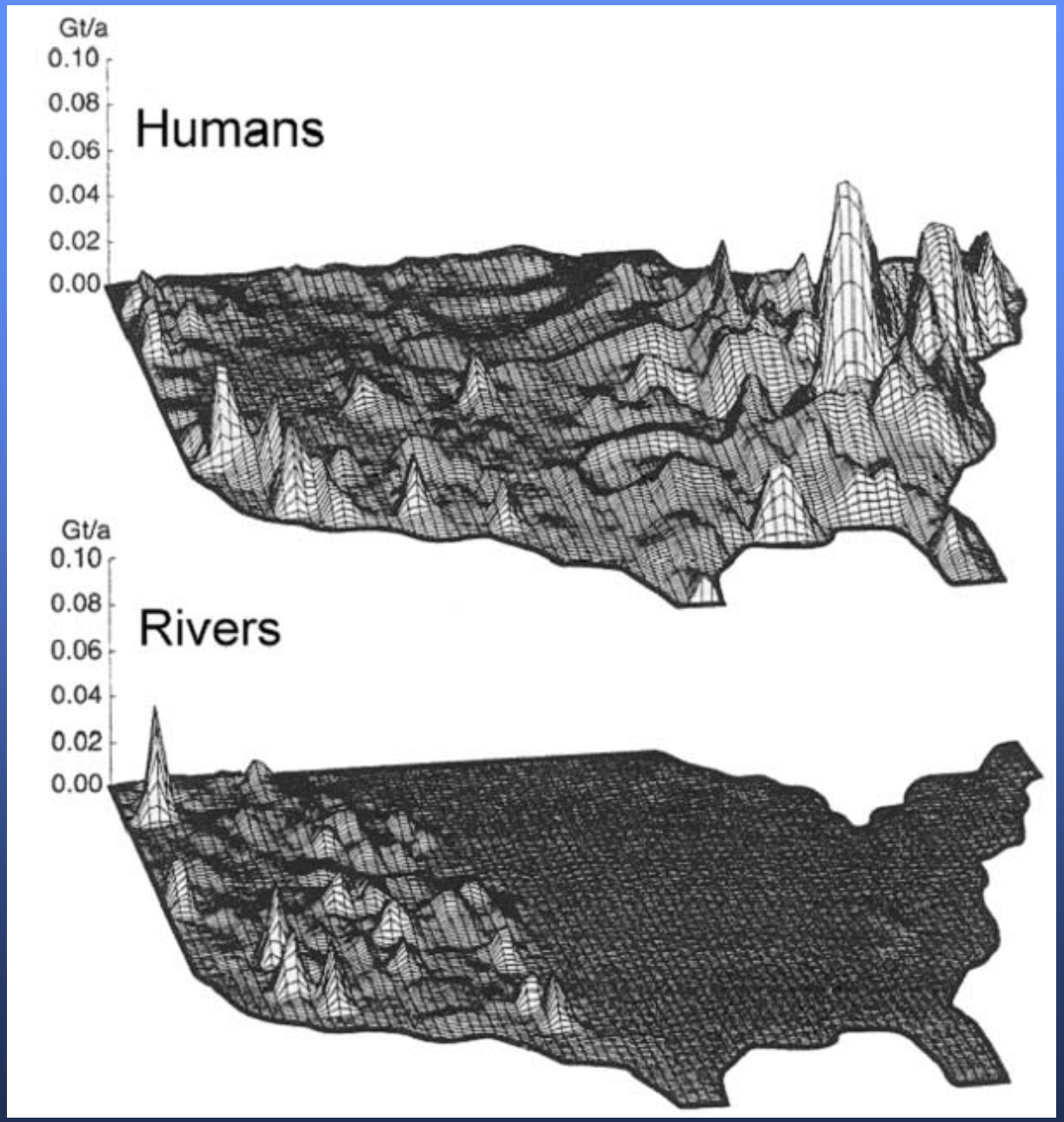
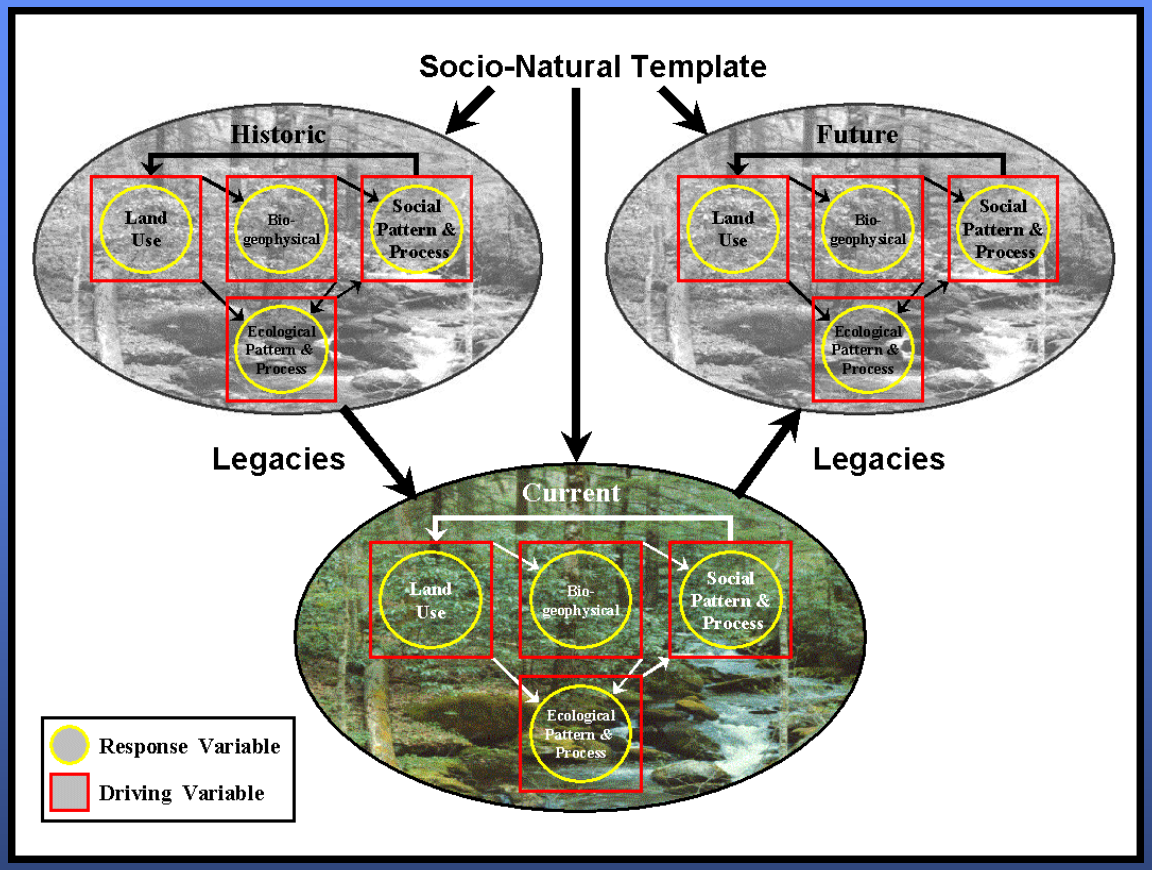


Some questions demand an interdisciplinary approach…

Gigatonnes of earth moved per annum in 1° lat-lon grid cells (after Hooke 1999).

CWT-LTER 2002-2008



Research Objective:

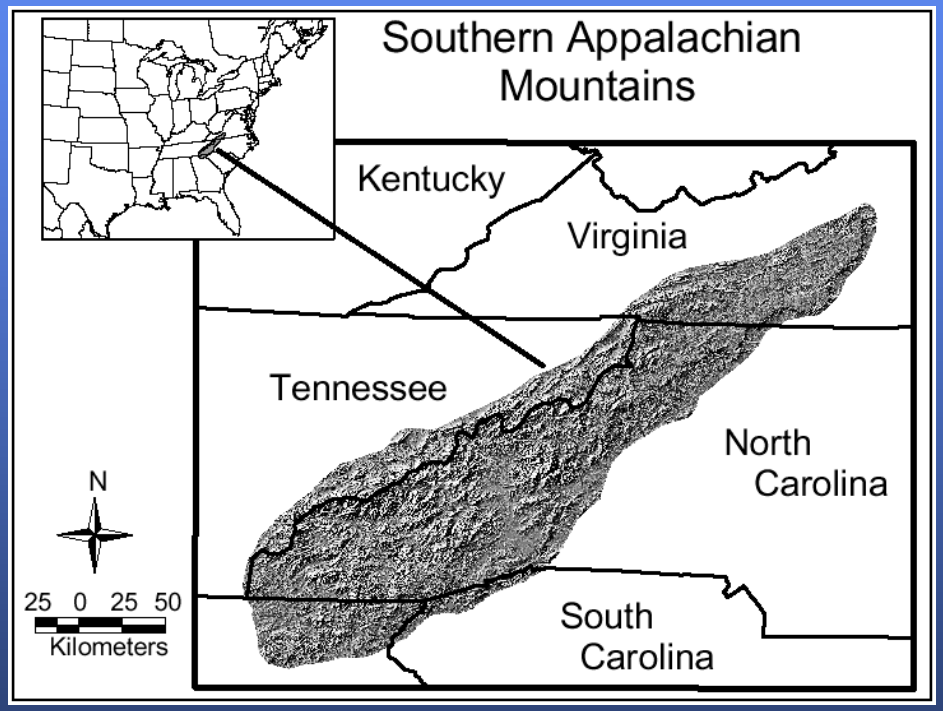
…advance scientific understanding of the spatial, temporal, and decision-making components of land use and land-use change in the southern Appalachian Mountains over the last 200 years, and forecast patterns into the future 30 years.

Guiding Hypothesis:

…the frequency, intensity, and extent of land use represents human decision-making in response to socioeconomic and biogeophysical conditions with consequences that cascade through ecosystems.

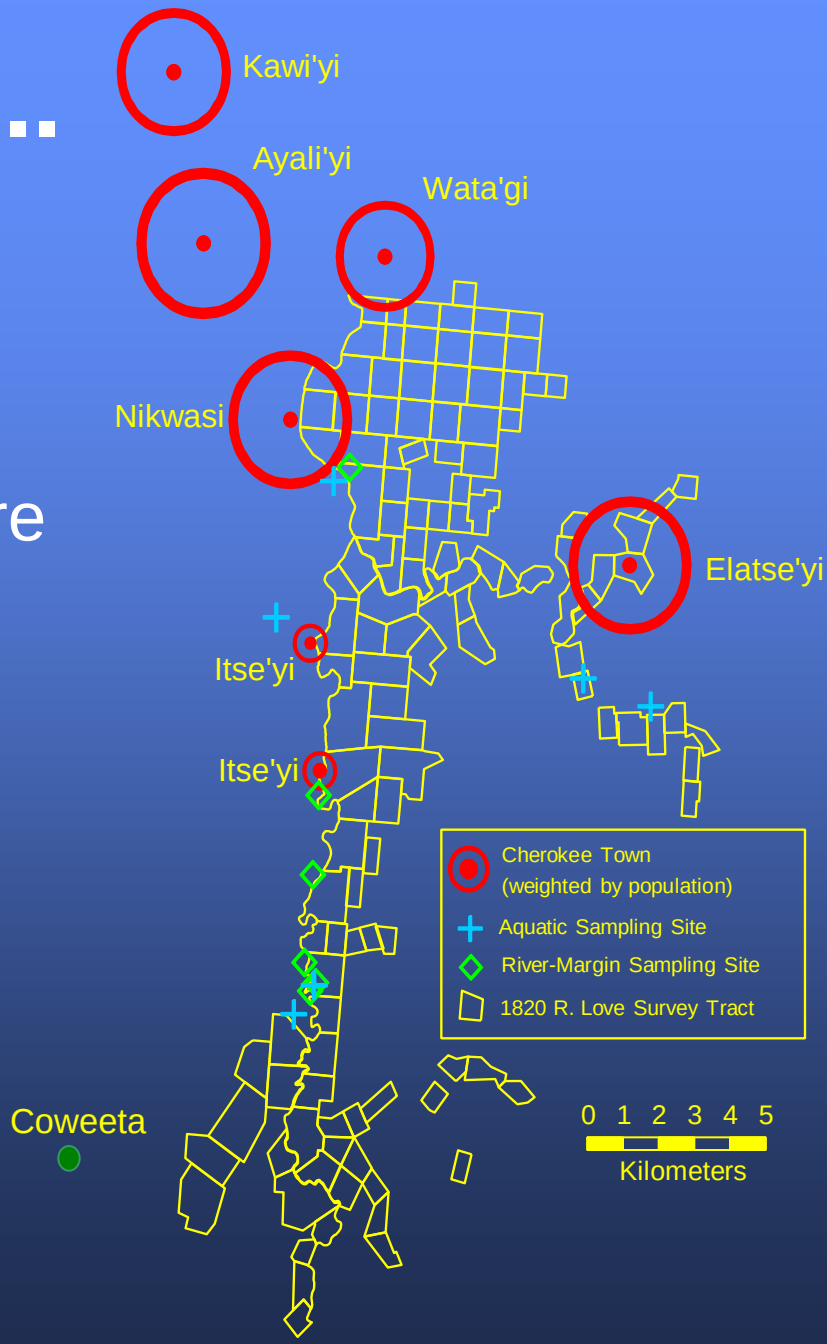
Research Team & Study Region

NAME	INSTITUTION	SPECIALTY
F. Benfield	Virginia Tech	Stream processes
P. Bolstad	**U Minnesota**	**Forest processes**
J. Clark	Duke U	Forest succession
B. Clinton	USDA-USFS	Response to disturbance
D. Coleman	U Georgia	Soil ecology/nutrient cycling
K. Elliott	USDA-USFS	Plant community ecology
T. Gragson	**U Georgia**	**Disturbance processes**
G. Grossman	U Georgia	Community/population ecology
B. Haines	U Georgia	Nutrient cycling in plants
G. Helfman	U Georgia	Fish ecology
R. Hendrick	U Georgia	Forest ecology
M. Hunter	U Georgia	Canopy herbivory
B. Kloeppel	U Georgia	Physiological gradients
J. Knoepp	USDA-USFS	Soil processes
D. Leigh	**U Georgia**	**Geomorphic processes**
J. Meyer	U Georgia	Stream processes
D. Newman	**U Georgia**	**Forest economics/policy**
S. Pearson	Mars Hill	Landscape ecology/modeling
C. Pringle	U Georgia	Stream processes
R. Pulliam	U Georgia	Theoretical ecology/modeling
B. Reynolds	UNC Asheville	Insect herbivory/litter organisms
M. Riedel	**USDA-USFS**	**Hydrology**
W. Swank	USDA-USFS	Hydrological dynamics/cycling
M. Turner	U Wisconsin	Landscape ecology/modeling
J. Vose	USDA-USFS	Forest processes
B. Wallace	U Georgia	Stream processes
D. Wear	**USDA-USFS**	**Economic modeling**
J. Webster	Virginia Tech	Stream processes



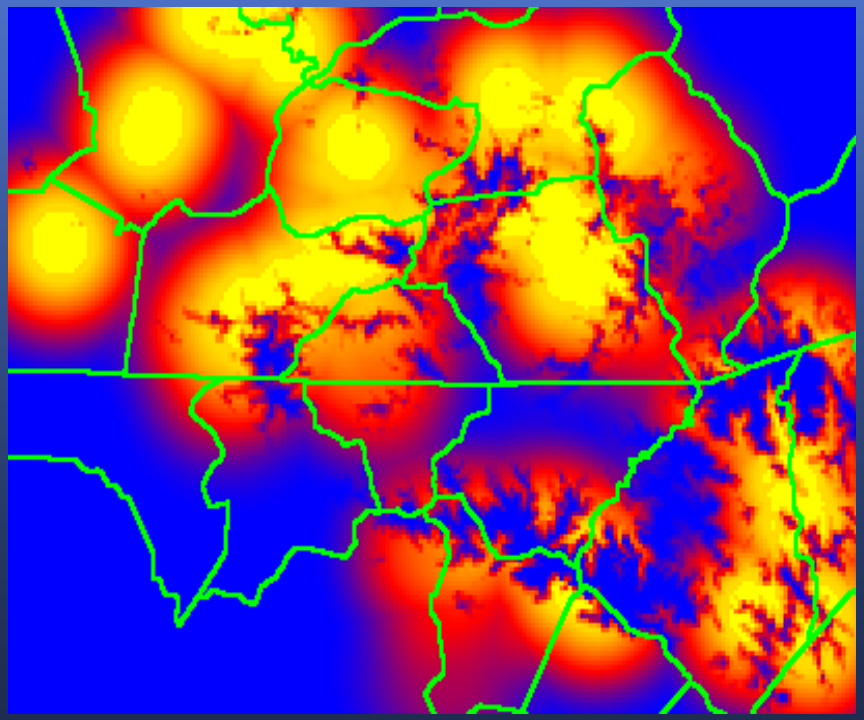
Land-use Legacies...

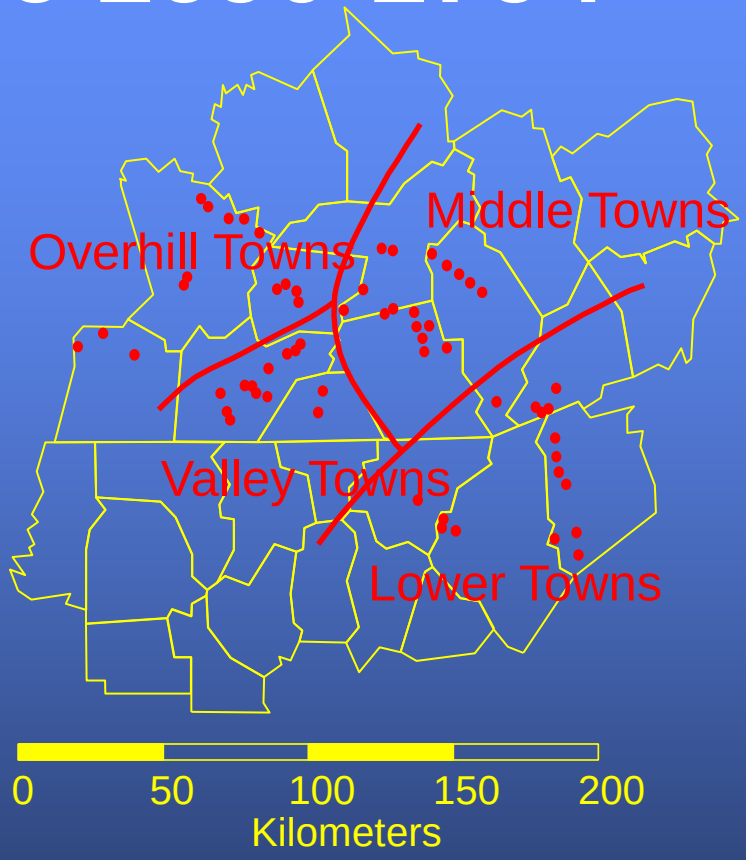
…are the cumulative effect of human activities at moments in time that constrain the opportunities of current and future generations.



Cherokee Land Use 1690-1794

1835 description of Cherokee County, NC:
…(T)he forests are generally very open… the trees are wide apart, and the fires which the Indians continually make to burn the undergrowth or brush…to facilitate hunting, remove the obstructions…to free passage in all directions (Browder 1973: 95).





Town Names	Men	Women	Children	Total
Checlokee	71	71	77	219
Tunnissee	160	193	190	543
Elojay	56	70	65	191
Noonnie	61	56	60	177
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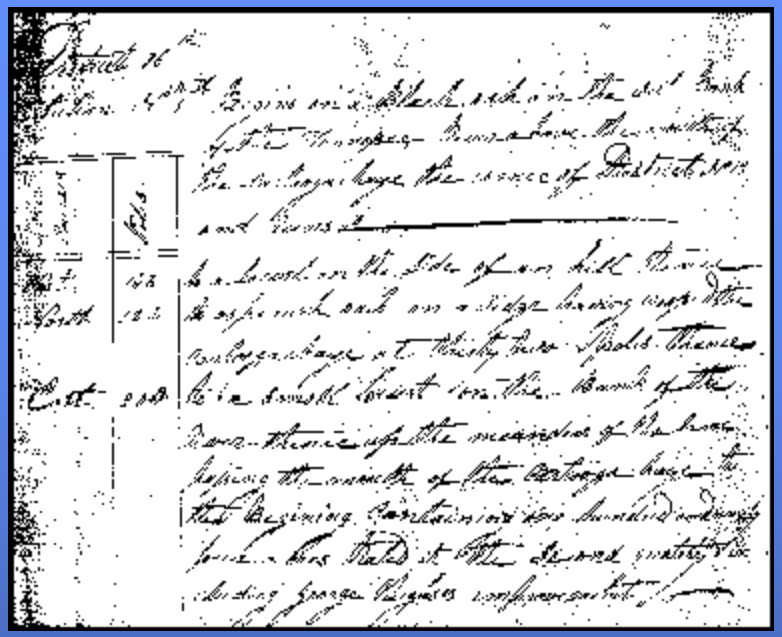
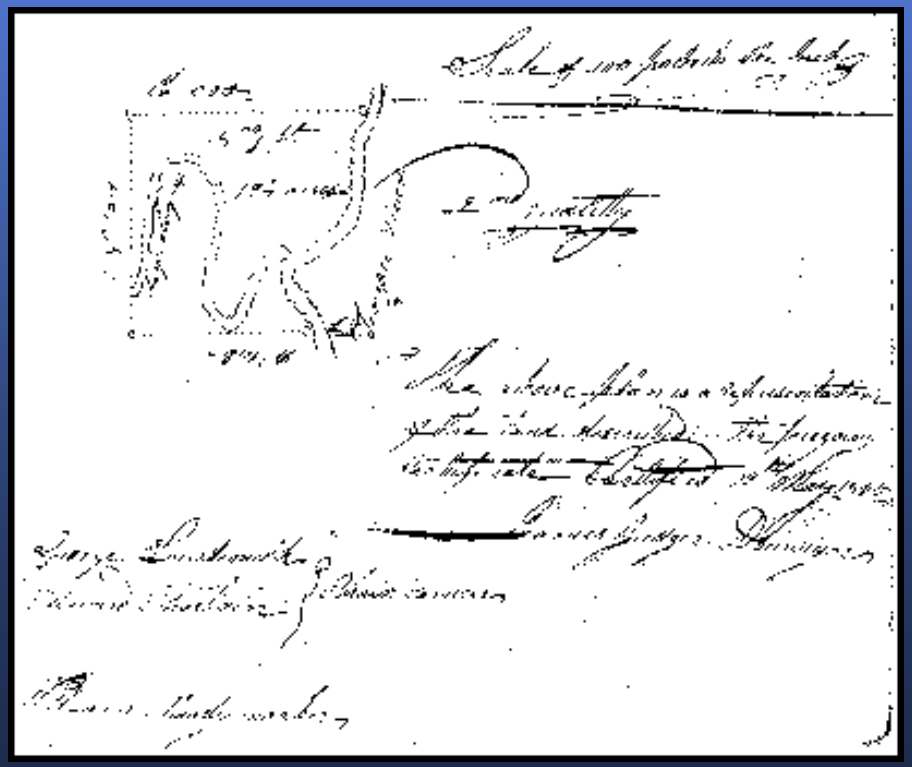
.	.	.	.	.

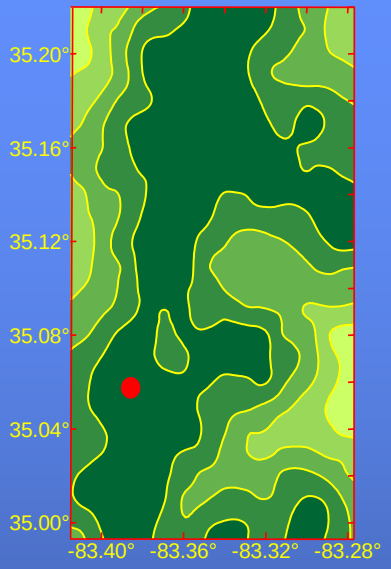
1820 Robert Love Survey

"…complete the survey in a timely fashion and produce three plat maps showing the location and situation of all surveyed land."

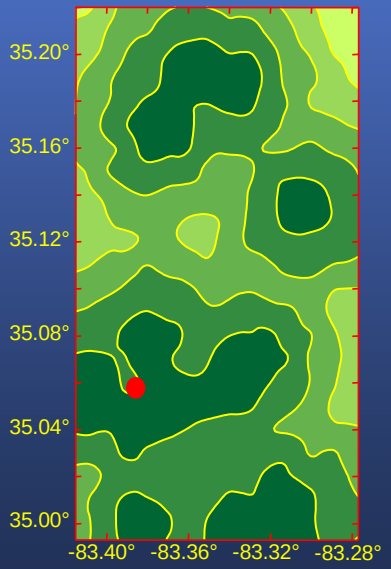




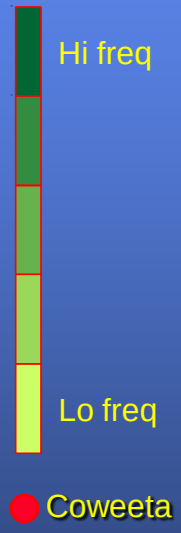
Witness Tree Patterns



Black Oak (*Q. velutina*)

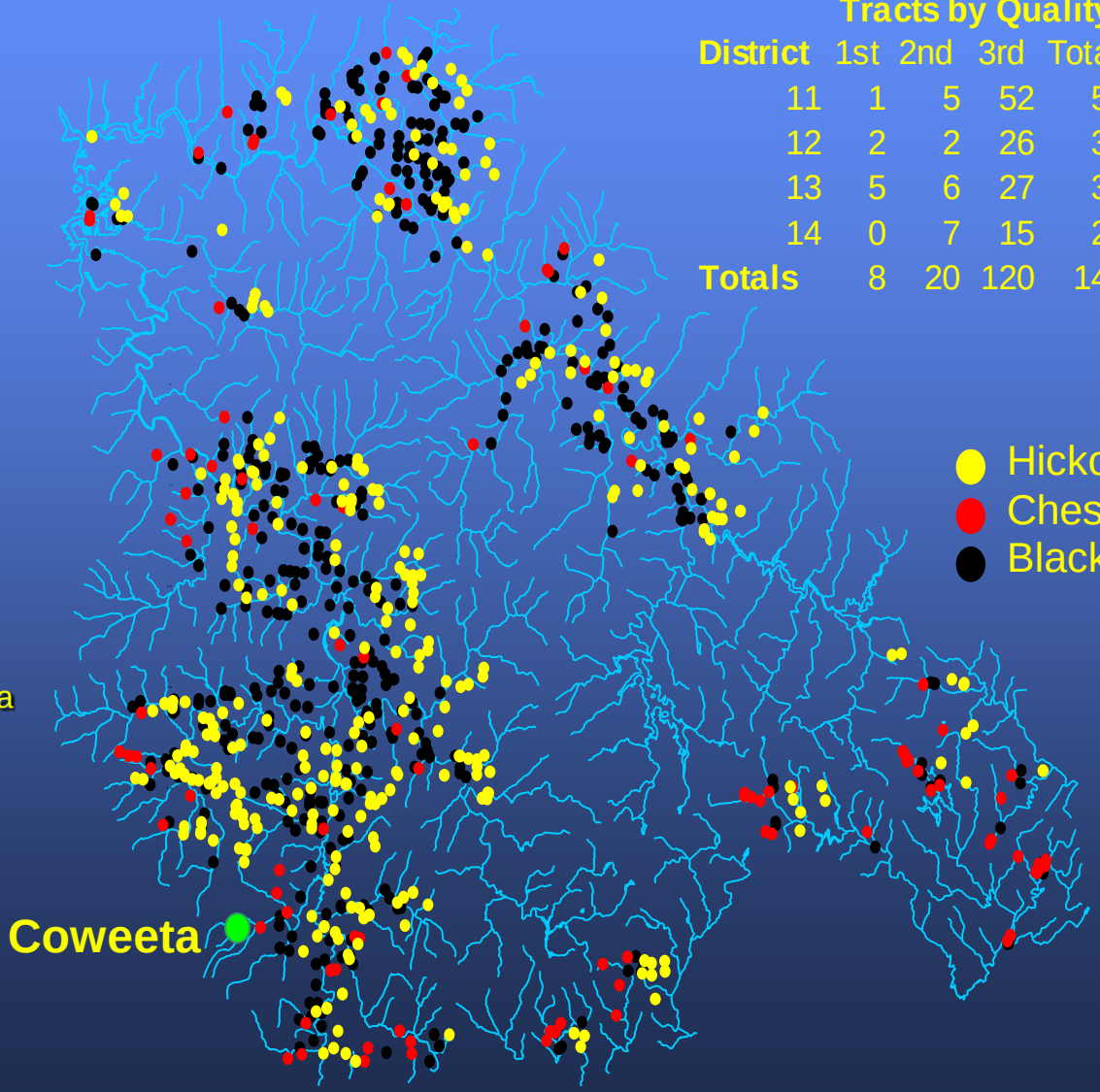


Chestnut (*C. dentata*)

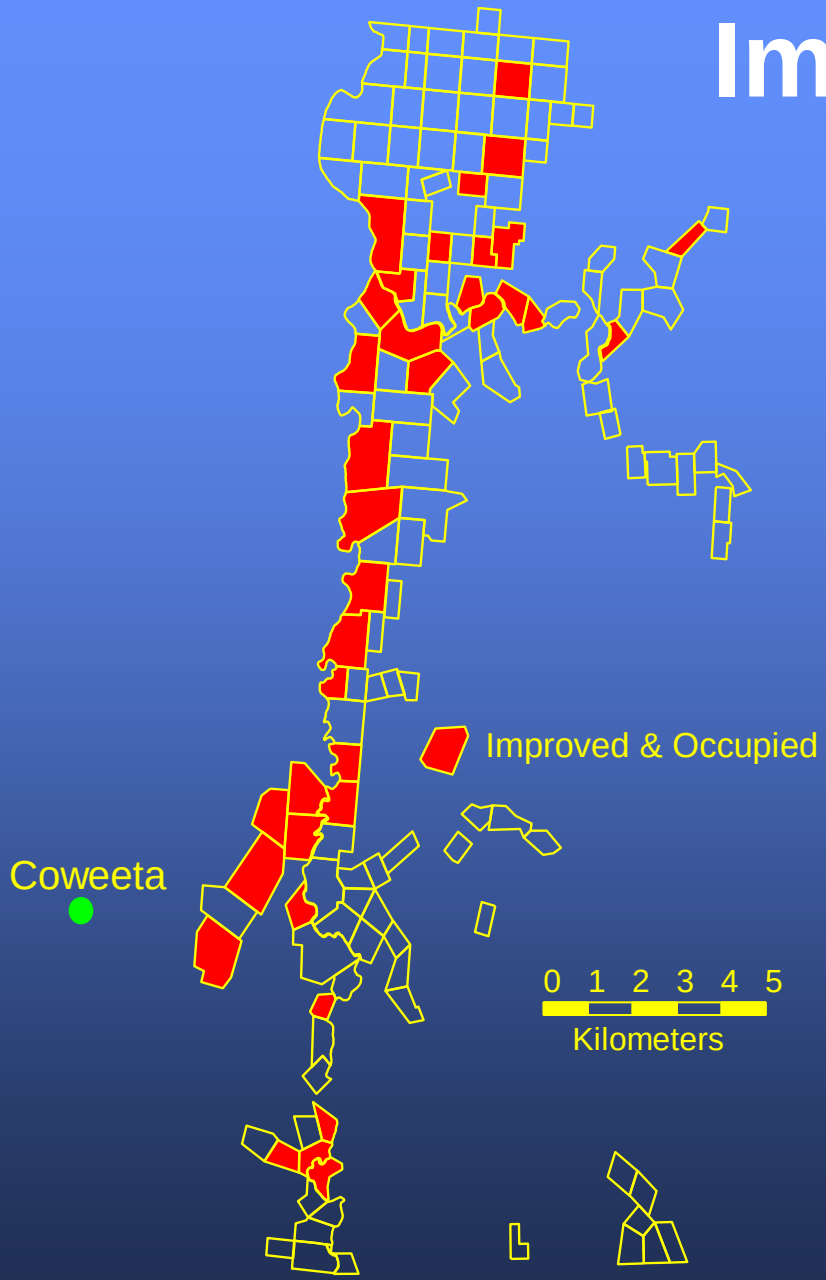


Tracts by Quality

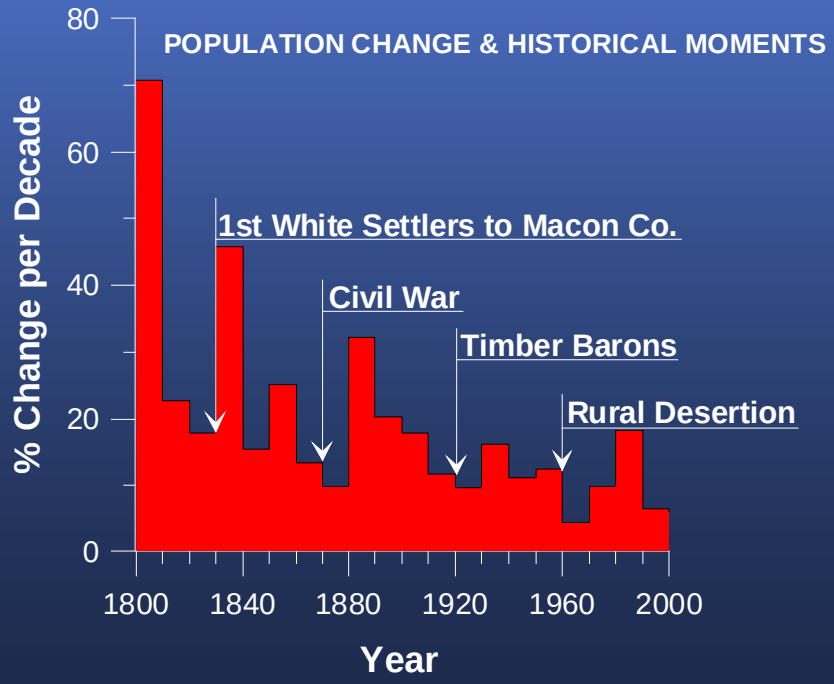
District	1st	2nd	3rd	Total	Acres
11	1	5	52	58	6,338
12	2	2	26	30	3,982
13	5	6	27	38	3,382
14	0	7	15	22	2,568
Totals	8	20	120	148	16,269



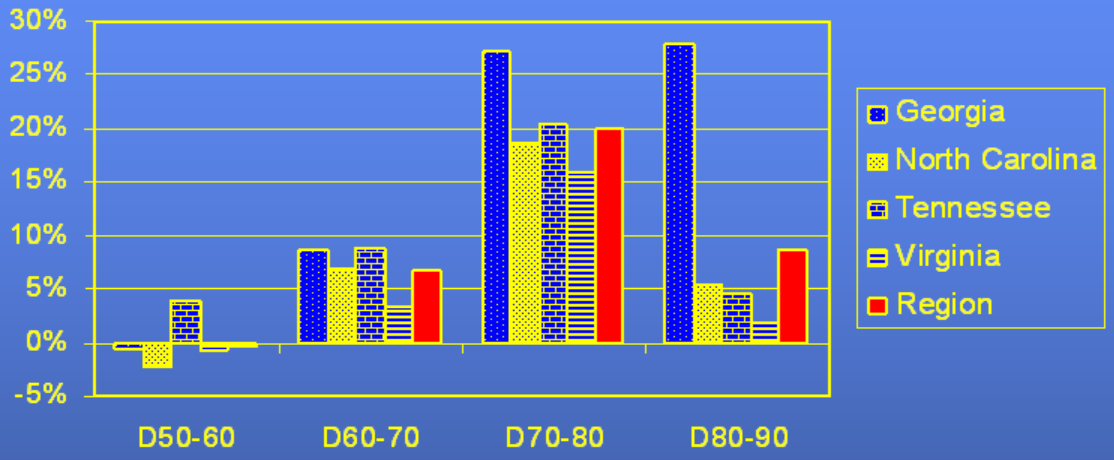
Improved & Occupied

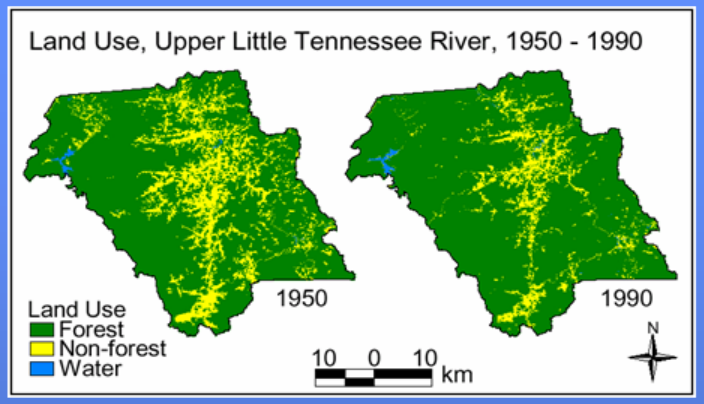


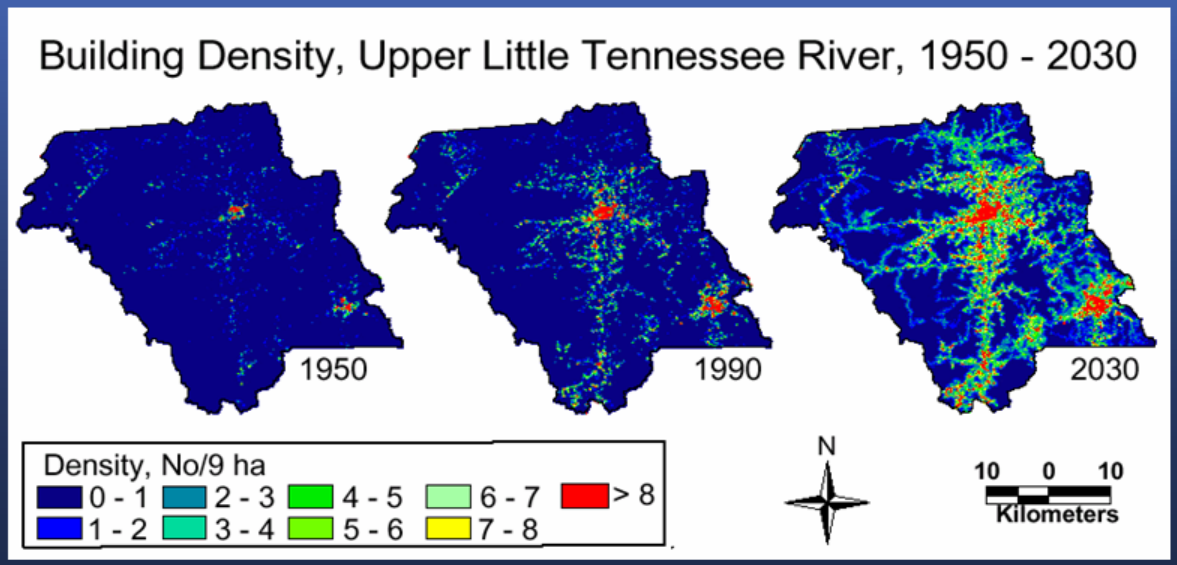
Name	Tracts	Acres	Price	%Total
Brittain	10	1861	$6,158	3.99
Bryson	15	1796	$4,631	3.85
Patton	10	1641	$3,656	3.52
Love	12	1594	$5,194	3.42
Welch	10	1477	$5,115	3.17
Siler	11	1167	$2,855	2.50
Brown	11	1084	$2,015	2.33
Shuler	7	1064	$3,670	2.28
Moore	9	997	$2,369	2.14
Johnson	7	949	$1,983	2.04
Addington	8	923	$1,747	1.98
Smith	8	897	$2,985	1.92



New Neighbors







Ruby Mathis: Back then people was neighbors, they're not anymore. They don't visit you, ner come around you, ner nothing. Back then when we killed a hog, all of our friends had a mess. Now people's for theirselves and nobody else. Don't never visit ner come along and the church is full ever week.

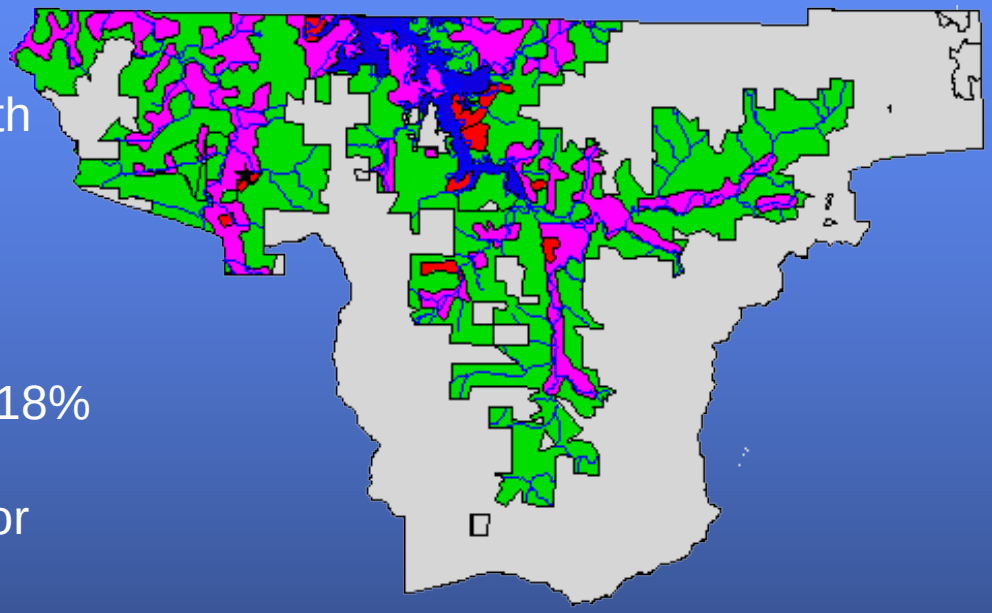
Southern Appalachian Land Shuffle

Towns Co. has the third smallest population in Georgia (8,500), but it is older and poorer:

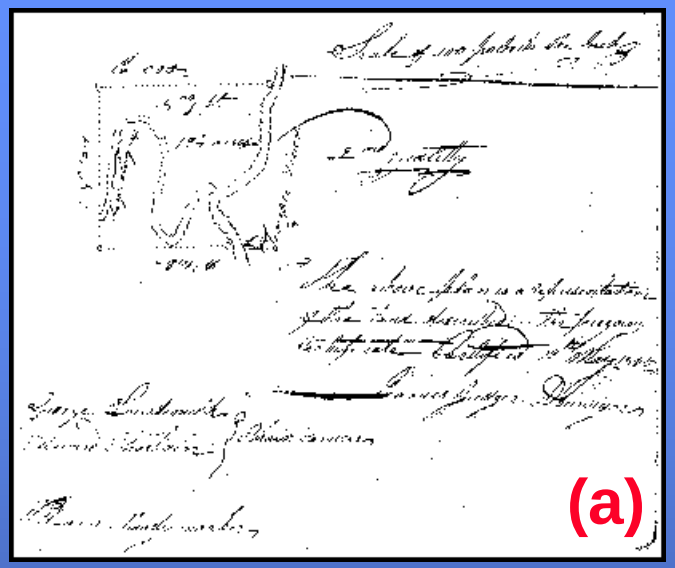
- Median age = 43.1 (GA = 31.5) with 25% over 65 (GA = 9.9%)
- 24.4% earn < $10K (GA = 16.8%)

The county is also one of the fastest growing:

- 26% growth between 1990-1998 (18% for GA)
- 100% due to net migration (60% for GA)



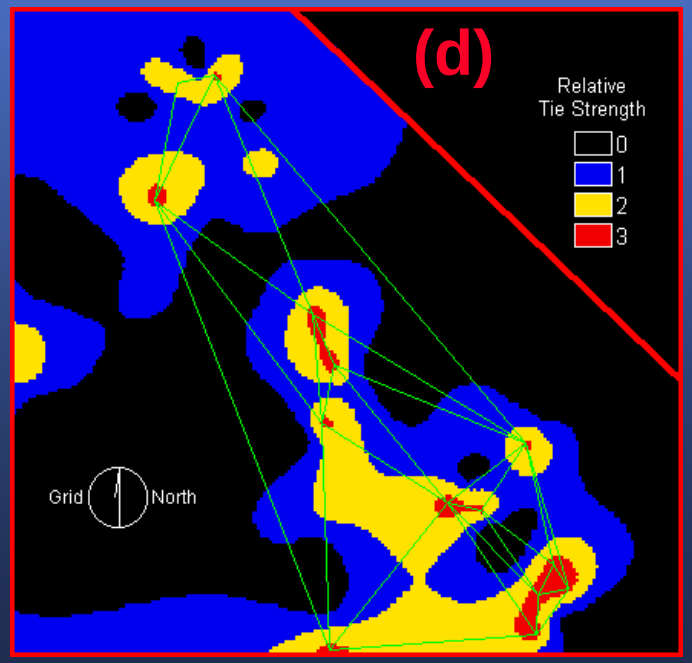
BENEFIT DERIVED FROM OWNERSHIP	$/yr	EMP	%TOT
Present enjoyment and eventually an estate	*$40-59k*	*Retired*	*60.5*
Estate to pass on to my children	*$20-39k*	*Retired*	*18.6*
Land investment for future profit	*$60-79k*	*Employed*	*15.1*
Real estate development for near-term profit	*$40-59k*	*Employed*	*5.8*



APR: Somebody told me that people that live in the mountains don't like the government. What do you think about that?

RUB: Well now the government's got their place. But I do think they exaggerate some things. They do. But we have to have 'em. They got their job and what you gonna do? (Laughs) We still got rules and regulations and you have to obey 'em too or they put you out of business.

(b)

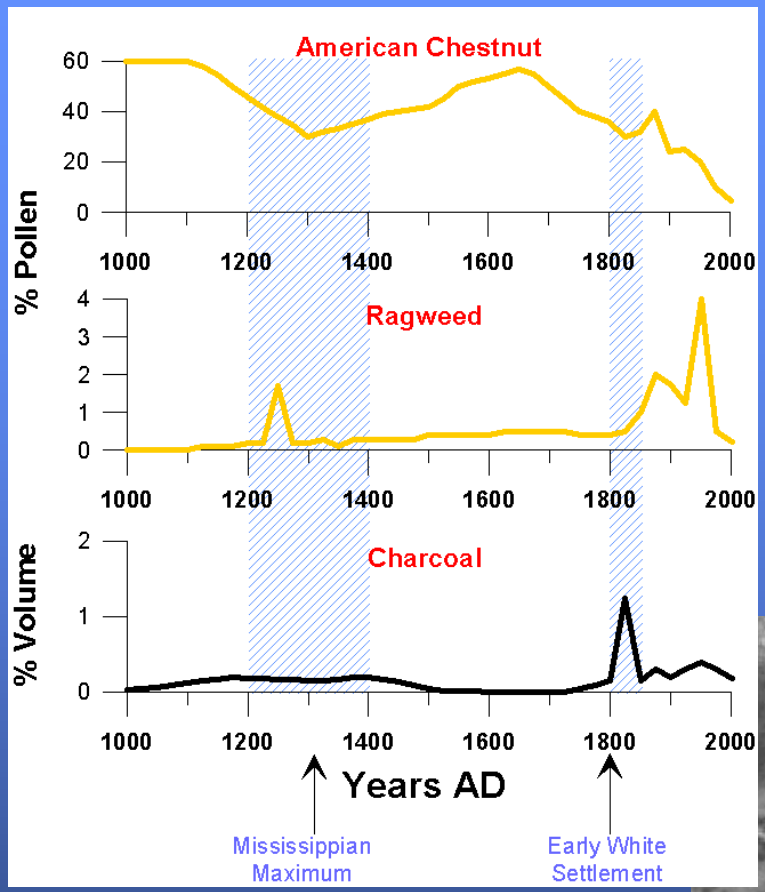


Methods

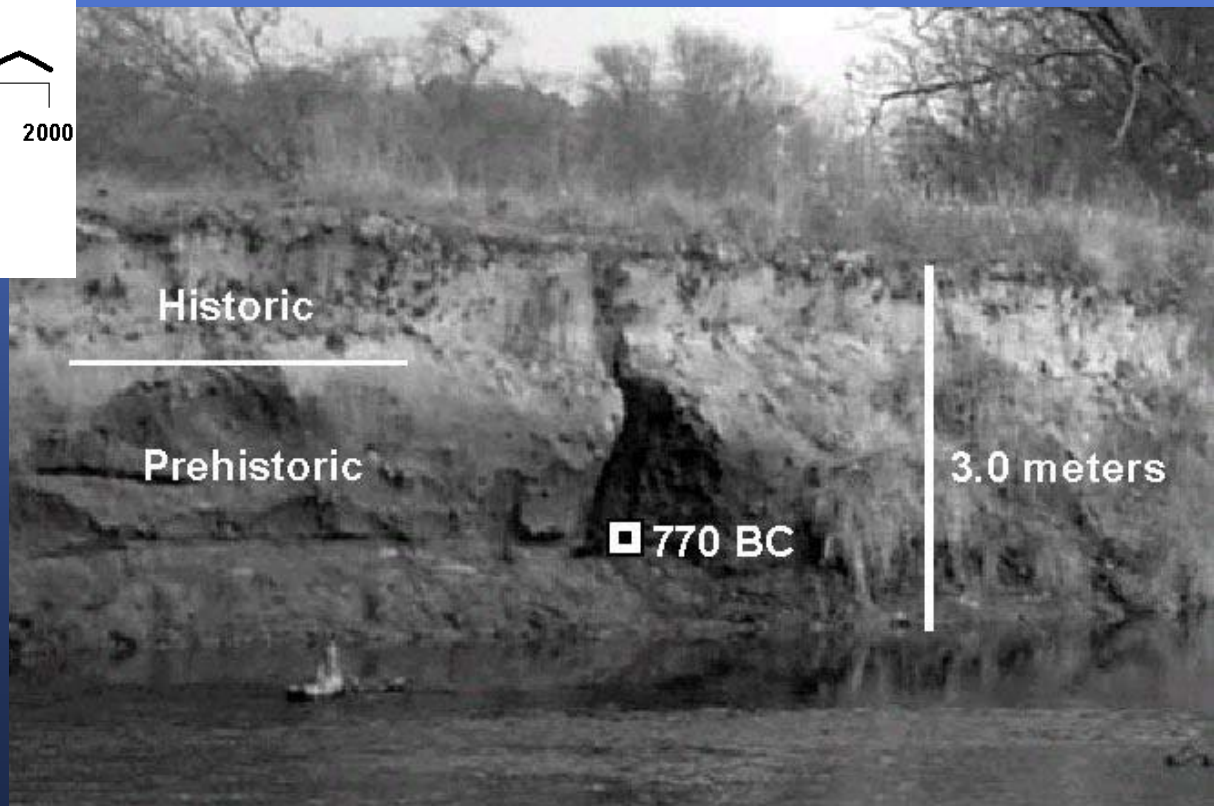
- Historical records
- Oral histories
- Paleoflood hydrology
- Analytical cartography

Chronosequencing Legacies

White Oak Bog



Little Tennessee River

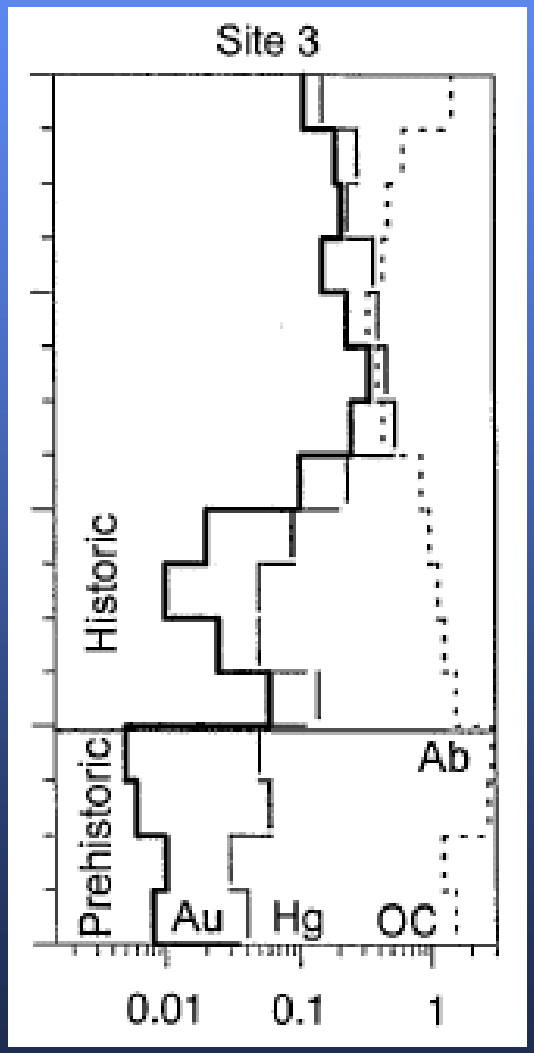


Sedimentation Rate:

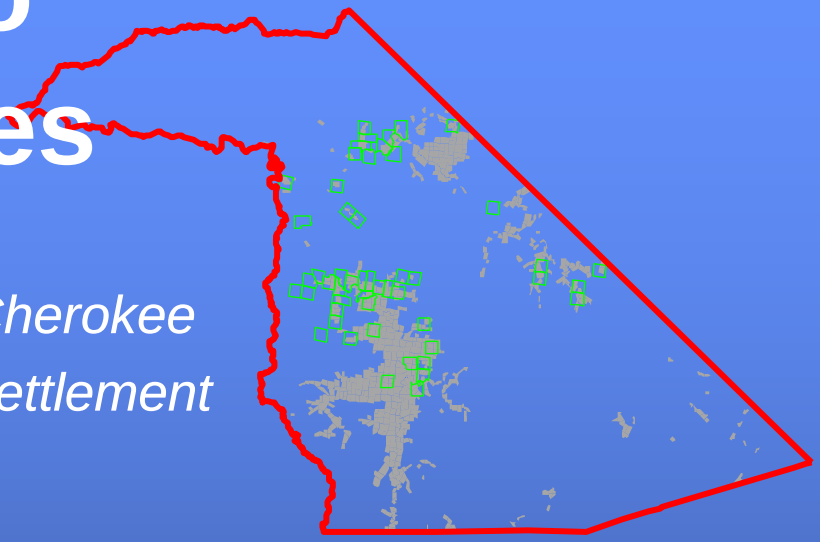
Prehistoric = 0.5 mm/y

Post-1800 = 5.0 mm/y

Linking Legacies to Historical Processes

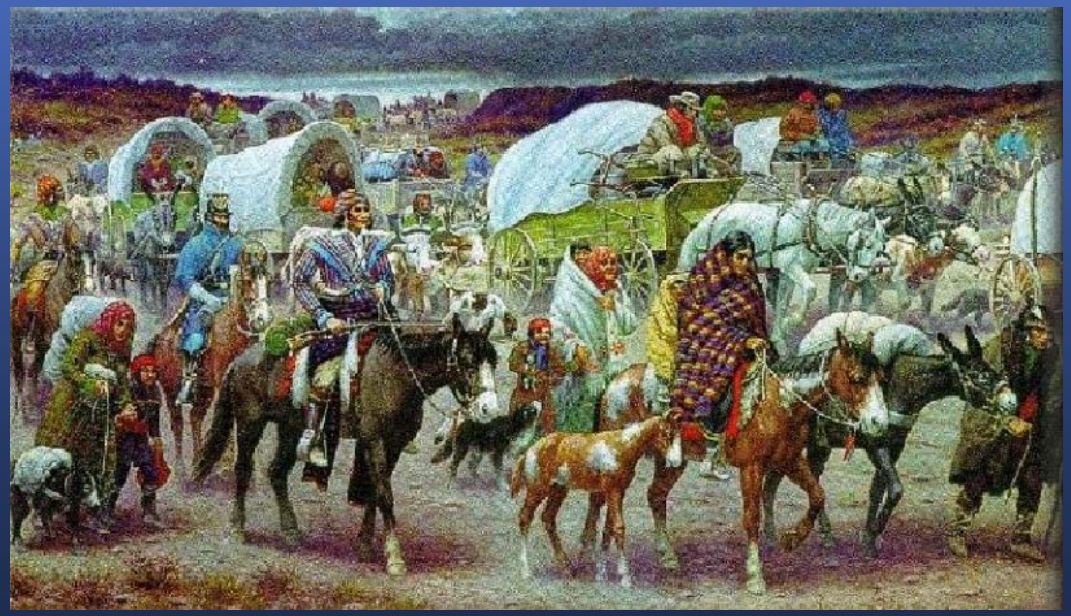


Citizen Cherokee Settlement

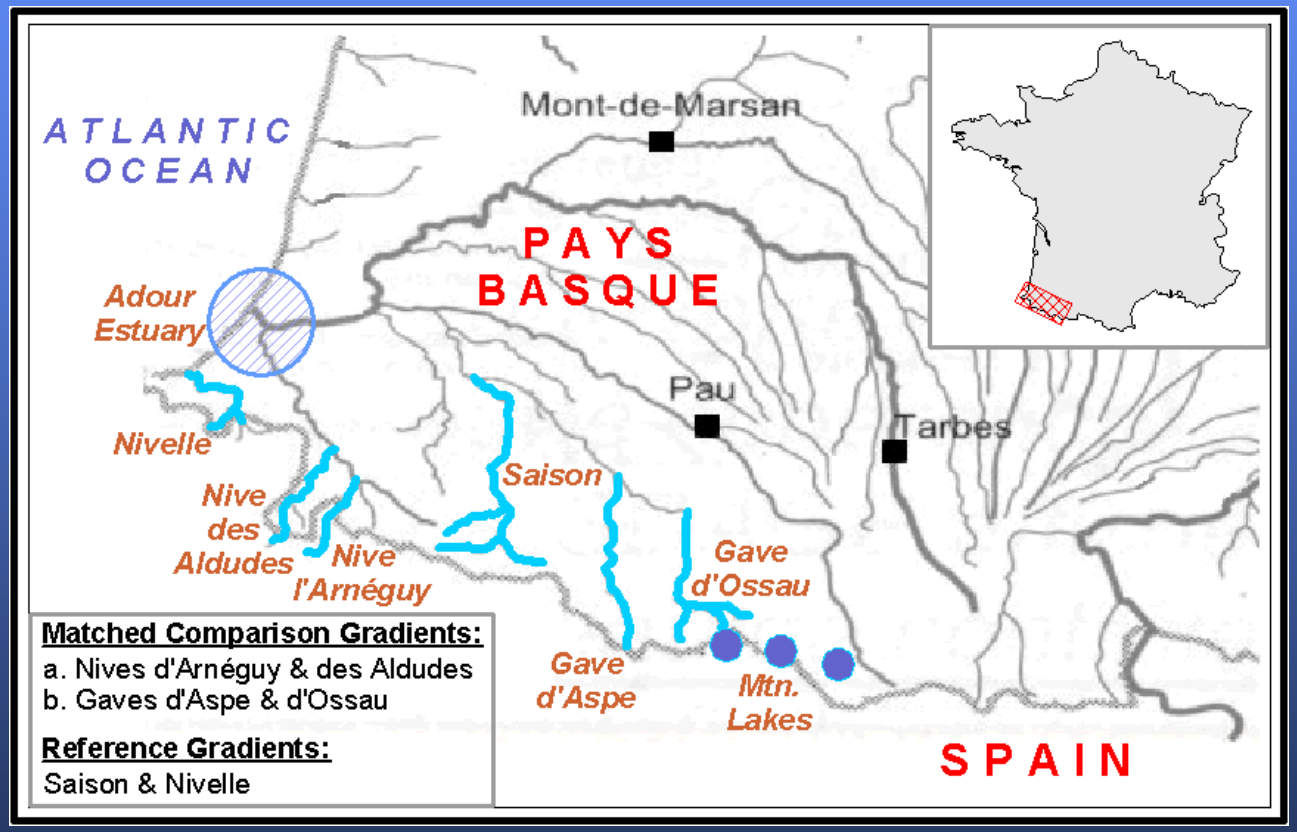


Mercury-tainted Sediments

Cherokee Trail of Tears



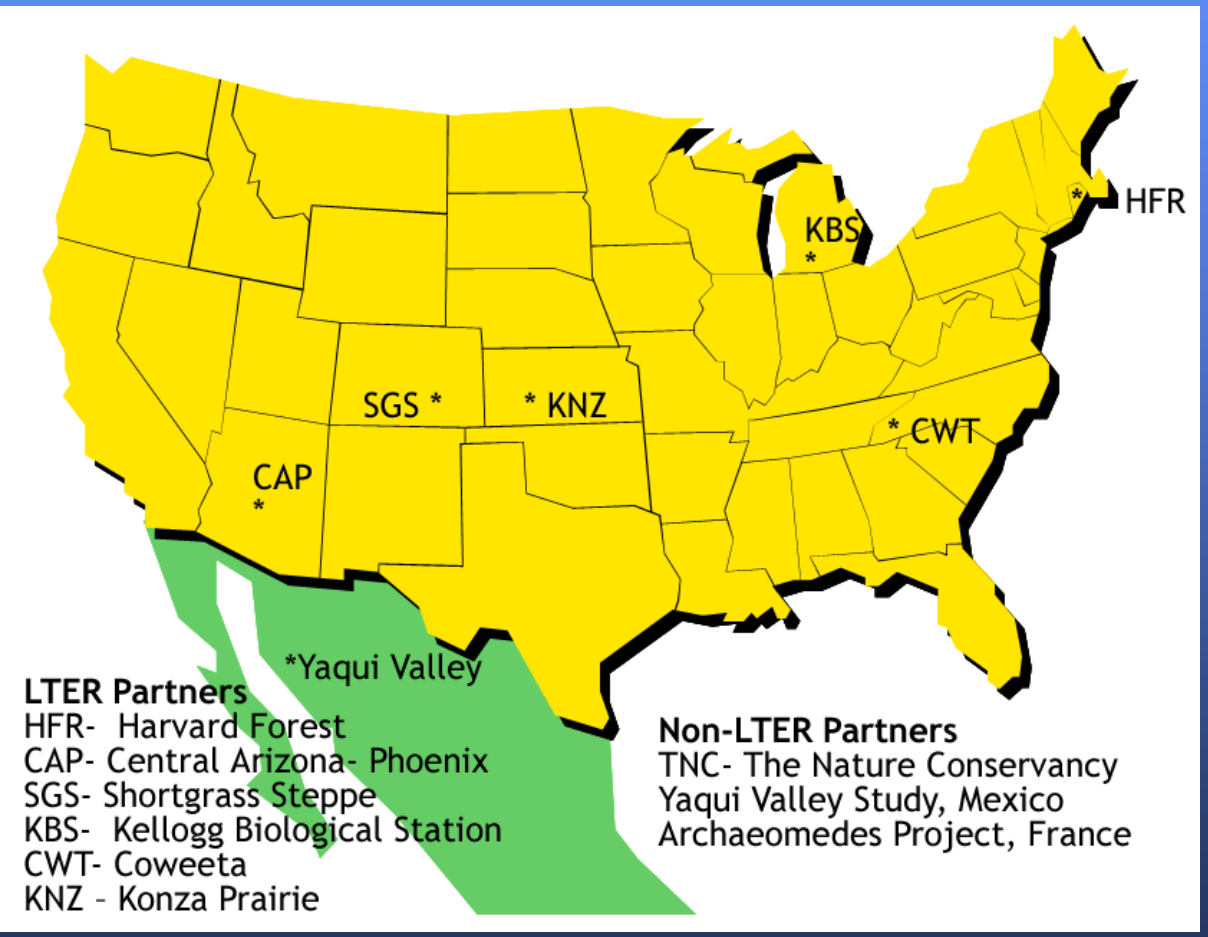
Hydrosystèmes Pyrénéens Site Atelier

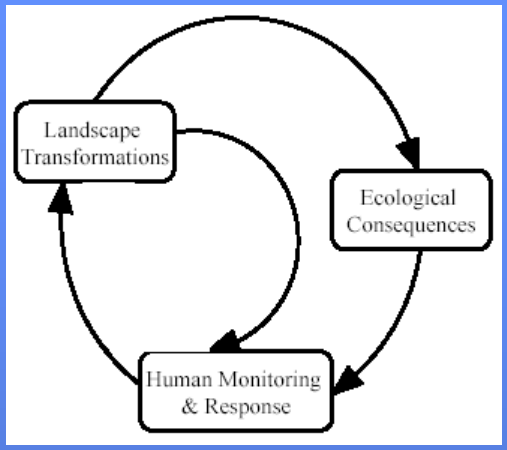


Initiatives:

1. Long-term human responses to natural and social constraints.
2. Biogeochemical transfers between terrestrial and aquatic systems.
3. Population-level responses of organisms at different positions along mountain streams (*gaves*).

Agricultural Landscapes in Transition





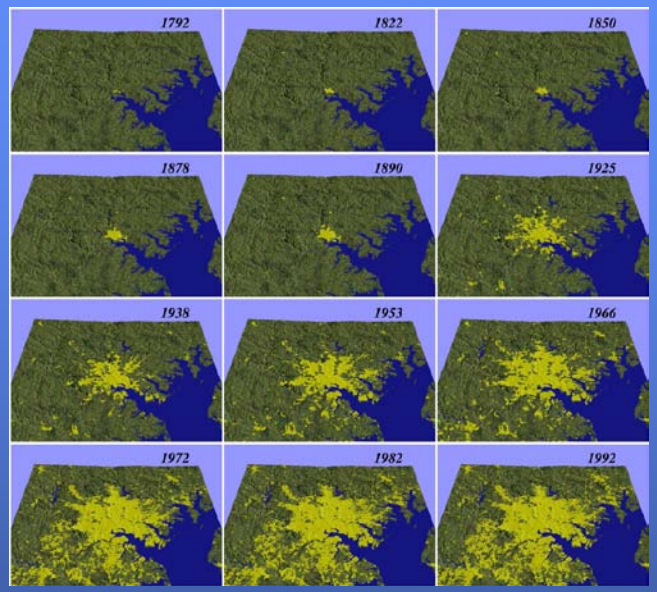
Objectives:

1. How do human activities influence the spatial and temporal structures of agrarian landscapes?
2. What are the ecological and environmental consequences of the resulting structural changes?
3. What are the human responses to both these structural and ecological changes, and how do these responses drive further changes in agrarian landscapes?

http://ces.asu.edu/agtrans/index.htm

Baltimore-LTER

- How have ecological systems influenced social patterns and processes in an urban ecosystem?
- How have social patterns and processes influenced use and management of ecological resources in an urban ecosystem?
- How are these interactions changing over time, and what does this mean for the urban ecosystem?



To what extent can variation in key ecological variables be explained by only geophysical factors and to what extent do human factors contribute to explaining the observed patterns?

CAP-LTER

In conclusion…

Boundaries between scientific disciplines are collapsing, and the rise of interdisciplinary sciences is challenging the very concept of "science as usual" (Jasanoff et al. 1997).

Our challenge is to move toward scientific practices that increase our understanding of the interaction between socioeconomic and biogeophysical conditions and the consequences that cascade through ecosystems across space and through time.