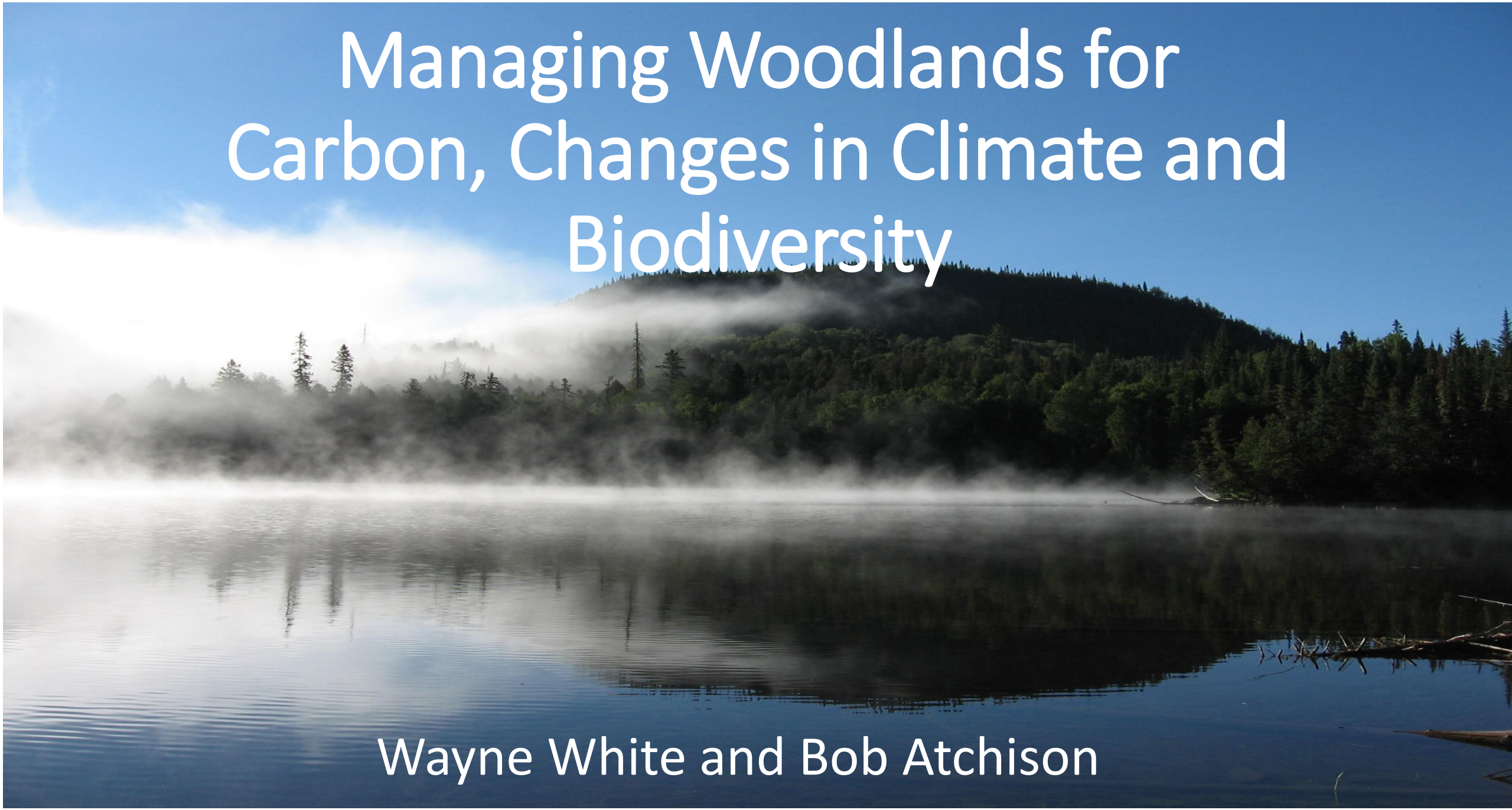


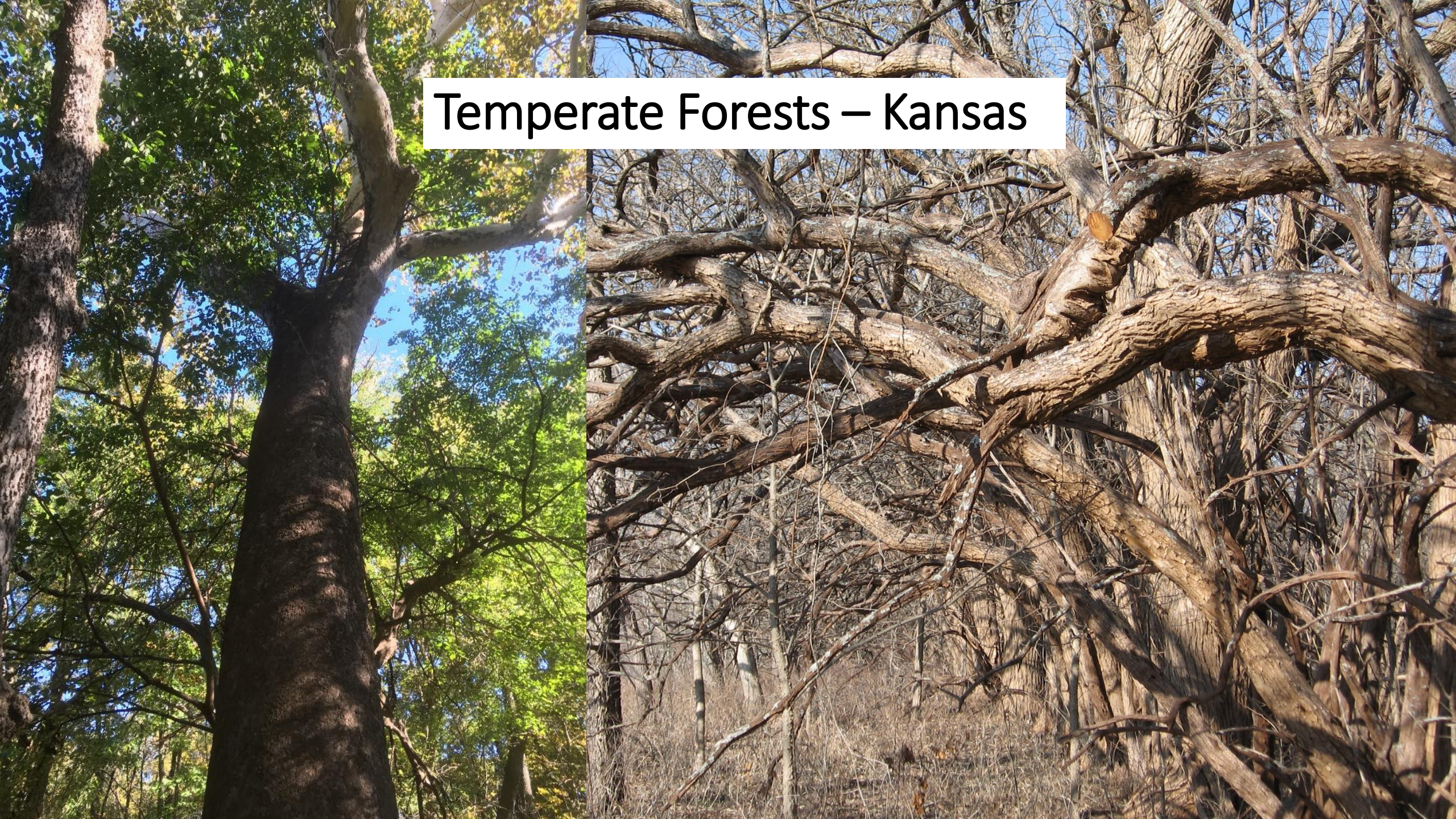
Managing Woodlands for Carbon, Changes in Climate and Biodiversity

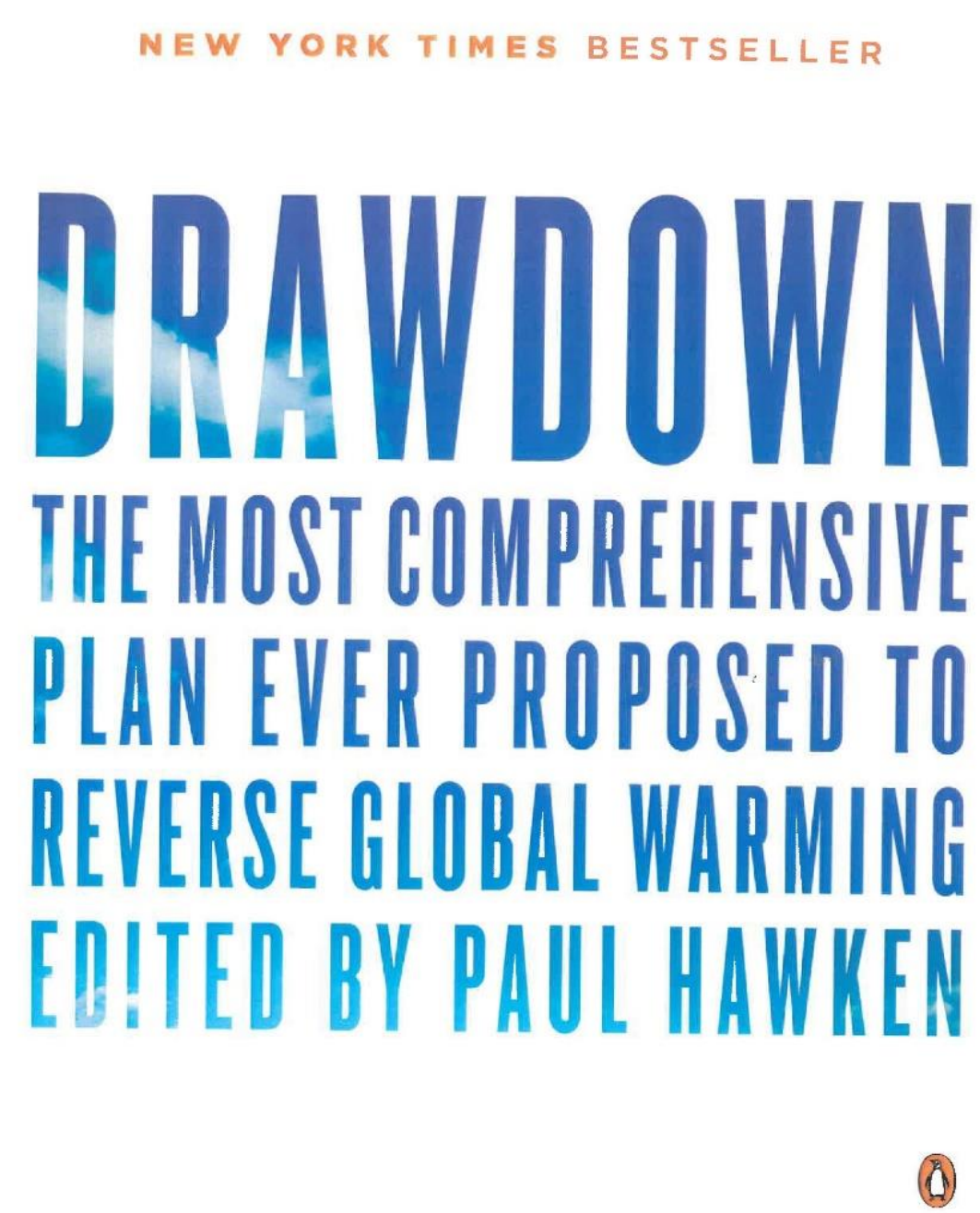
Wayne White and Bob Atchison

Tropical Forests – Costa Rica

Boreal Forests – Ontario

Temperate Forests – Kansas





Expand temperate forests by natural regeneration to 235 million acres by 2050

nk	Solution	Sector	TOTAL ATMOSPHERIC CO2-EQ REDUCTION (GT)	NET COST (BILLIONS US $)	SAVINGS (BILLIONS US $)
1	Refrigerant Management	Materials	89.74	N/A	$-902.77
2	Wind Turbines (Onshore)	Electricity Generation	84.60	$1,225.37	$7,425.00
3	Reduced Food Waste	Food	70.53	N/A	N/A
4	Plant-Rich Diet	Food	66.11	N/A	N/A
5	Tropical Forests	Land Use	61.23	N/A	N/A
6	Educating Girls	Women and Girls	51.48	N/A	N/A
7	Family Planning	Women and Girls	51.48	N/A	N/A
8	Solar Farms	Electricity Generation	36.90	$-80.60	$5,023.84
9	Silvopasture	Food	31.19	$41.59	$699.37
10	Rooftop Solar	Electricity Generation	24.60	$453.14	$3,457.63
11	Regenerative Agriculture	Food	23.15	$57.22	$1,928.10
12	Temperate Forests	Land Use	22.61	N/A	N/A
13	Peatlands	Land Use	21.57	N/A	N/A
14	Tropical Staple Trees	Food	20.19	$120.07	$626.97
15	Afforestation	Land Use	18.06	$29.44	$392.33

USFS Northern Research Station Climate Change Tree Atlas Model for Kansas Winners Based on High Carbon Scenario - change in relative abundance

Spp#	SppCN	SppSN	ClimIndx	ModRely	ModCur	HadHiDif	PcmLoDif	Gcm3AvgHiDif	Gcm3Avg LoDif
313	boxelder	Acer negundo	0	2	2.15	2.72	0.86	3.47	2.72
823	bur oak	Quercus macrocarpa	0	2	2.56	1.73	0.67	2	1.53
971	winged elm	Ulmus alata	4.5	1	0.01	0.92	0.63	0.85	0.67
835	post oak	Quercus stellata	4	1	0.89	0.76	1.13	0.6	0.78
951	American basswood	Tilia americana	1	2	0.19	0.47	-0.08	0.54	0.18
461	sugarberry	Celtis laevigata	0	2	0.06	0.53	0.63	0.48	0.51
766	wild plum	Prunus americana	2.5	3	0.03	0.31	0.2	0.41	0.16
452	northern catalpa	Catalpa speciosa	0	3	0.48	0.35	0.55	0.38	0.41
373	river birch	Betula nigra	2	3	0	0.15	0	0.33	0
824	blackjack oak	Quercus marilandica	3	2	0.39	0.37	0.9	0.29	0.49
921	peachleaf willow	Salix amygdaloides	1	3	0	0	0	0.27	0
809	northern pin oak	Quercus ellipsoidalis	4	2	0	0.21	0	0.25	0.03
922	black willow	Salix nigra	3	3	1.19	-0.09	0.4	0.2	-0.01
827	water oak	Quercus nigra	2.5	1	0	0.36	0.08	0.16	0.09
131	loblolly pine	Pinus taeda	3.5	1	0	0.45	0.06	0.15	0.05
408	black hickory	Carya texana	3.5	1	0.04	0.12	0.19	0.09	0.11
404	pecan	Carya illinoinensis	2.5	3	0.22	0.13	0.5	0.07	0.2
746	quaking aspen	Populus tremuloides	4	1	0	0.02	0	0.07	0
901	black locust	Robinia pseudoacacia	0	3	0.54	-0.21	1.05	0.06	0.69
110	shortleaf pine	Pinus echinata	3.5	1	0	0.06	0.06	0.04	0.05
317	silver maple	Acer saccharinum	2.5	2	0.79	-0.06	0.44	0.04	-0.13
409	mockernut hickory	Carya tomentosa	3.5	1	0.04	0.05	0.11	0.04	0.04
973	cedar elm	Ulmus crassifolia	3	3	0	0.04	0.01	0.04	0.03
94	white spruce	Picea glauca	3.5	2	0	0	0	0.03	0
129	eastern white pine	Pinus strobus	3	1	0	0	0	0.03	0
834	Shumard oak	Quercus shumardii	3	3	0	0.03	0.01	0.02	0.02
611	sweetgum	Liquidambar styraciflua	2.5	1	0	0.04	0.02	0.01	0.01
741	balsam poplar	Populus balsamifera	4.5	1	0	0	0	0.01	0
812	southern red oak	Quercus falcata var.falcata	3.5	1	0	0.04	0.02	0.01	0.01

Assesses current status (2,000) and potential future status (2,100) of tree species. ID suitable habitat based on FIA data and change climate according to 3 General Circulation Models (GCM). It also maps shifts in distribution.

General Circulation Model (GCM) shows the change in relative abundance for tree species for a high carbon scenario.

Top 6 species to weather climate change in KS?

1. Boxelder
2. Bur Oak
3. Winged Elm
4. Post Oak
5. American basswood
6. Sugarberry

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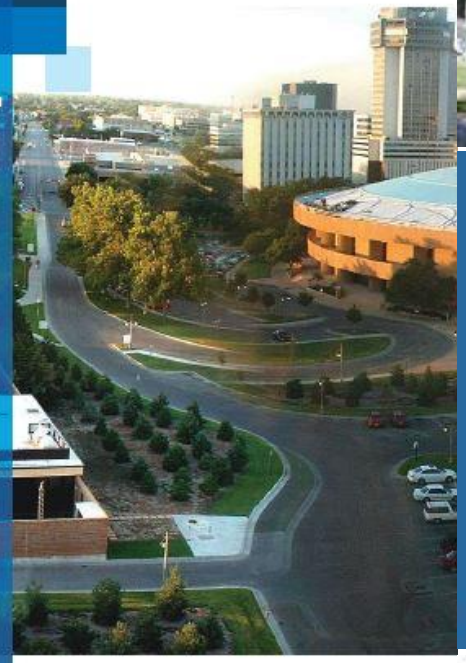
URBAN TREE CANOPY
ASSESSMENT



WICHITA,
KANSAS
OCTOBER | 2018

22,994
ACRES OF TREE CANOPY

23%
URBAN TREE CANOPY

33%
IMPERVIOUS SURFACE

45%
POSSIBLE PLANTING AREA

Figure 2. | Based on an analysis of 2017 high-resolution imagery, Wichita contains 23% tree canopy, 45% areas that could support canopy in the future, and 33% total impervious areas.

Table 1. | Generalized land cover classification results

Wichita	City Boundary	Tree Canopy	Non-Canopy Vegetation	Impervious Surfaces	Soil & Dry Vegetation	Water
Acres	105,211	22,994	41,390	33,421	3,729	3,677
% of Total	100%	22%	39%	32%	4%	3%

plan-it GEO

CITY OF WICHITA

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

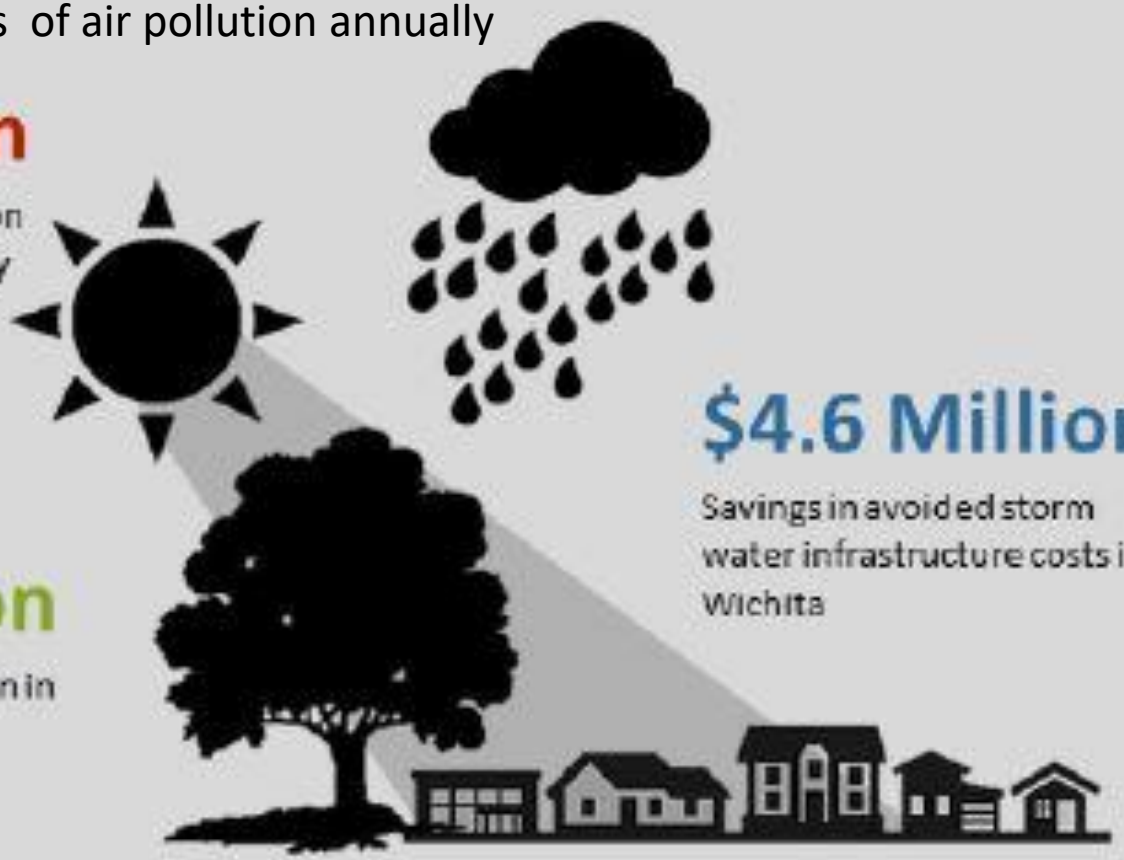
KANSAS FOREST SERVICE KANSAS STATE UNIVERSITY

QUANTIFYING ECOSYSTEM BENEFITS

Removes 2.9 million tons of air pollution annually

$107 Million

Annual savings in air pollution removal services provided by the current tree canopy in Wichita



$4.6 Million

Savings in avoided storm water infrastructure costs in Wichita

$100 Million

Value of total stored carbon in Wichita's tree canopy

i-Tree

Tools for Assessing and Managing **Forests & Community Trees**

On acre of tree canopy absorbs 22,000 gallons of water. This provides an estimated $4.6 million in stormwater runoff benefits to the City of Wichita

Wichita's trees store approximately 2,850,187 tons of carbon, valued at $100,840,211, and each year the tree canopy absorbs and sequesters approximately 101,428 tons of carbon dioxide, valued at $3,588,533.

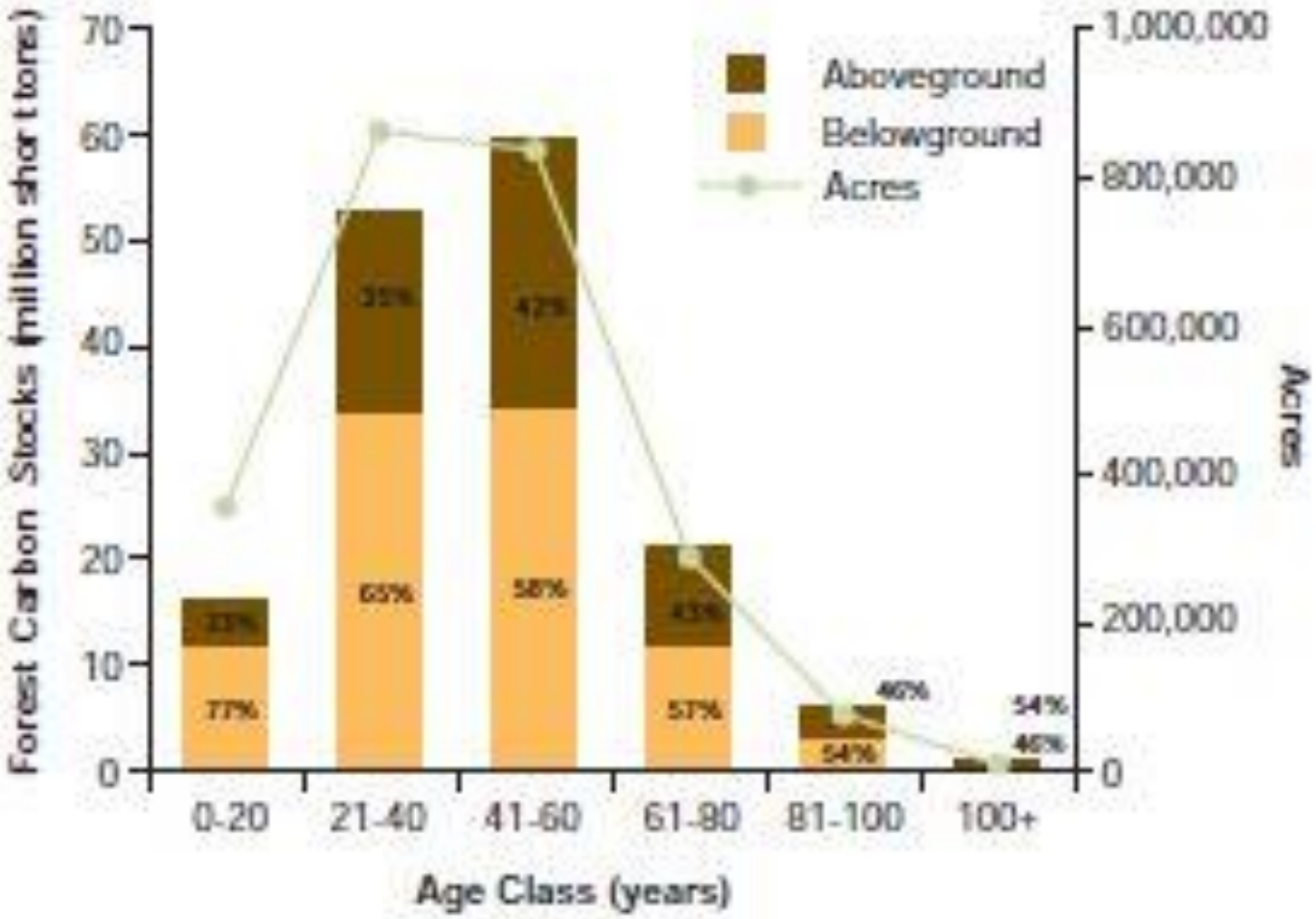


Figure 71.—Estimated aboveground and belowground carbon stocks on forest land, by stand-age class, Kansas, 2006-2010.

Kansas Forests contain 156 million tons of carbon storage

Forest soils store 87 million tons

Majority of carbon is in young stands 21 to 60 years of age

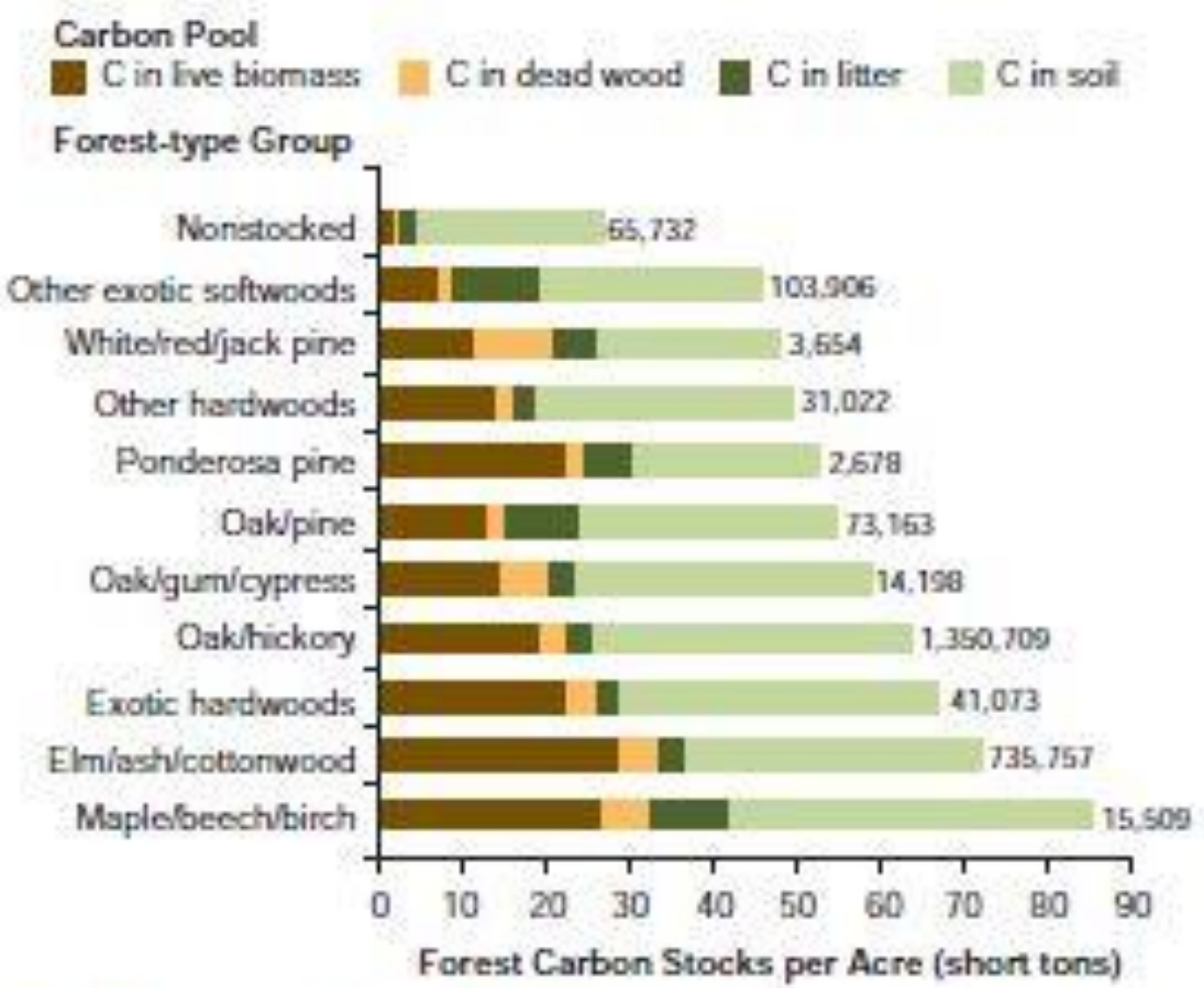
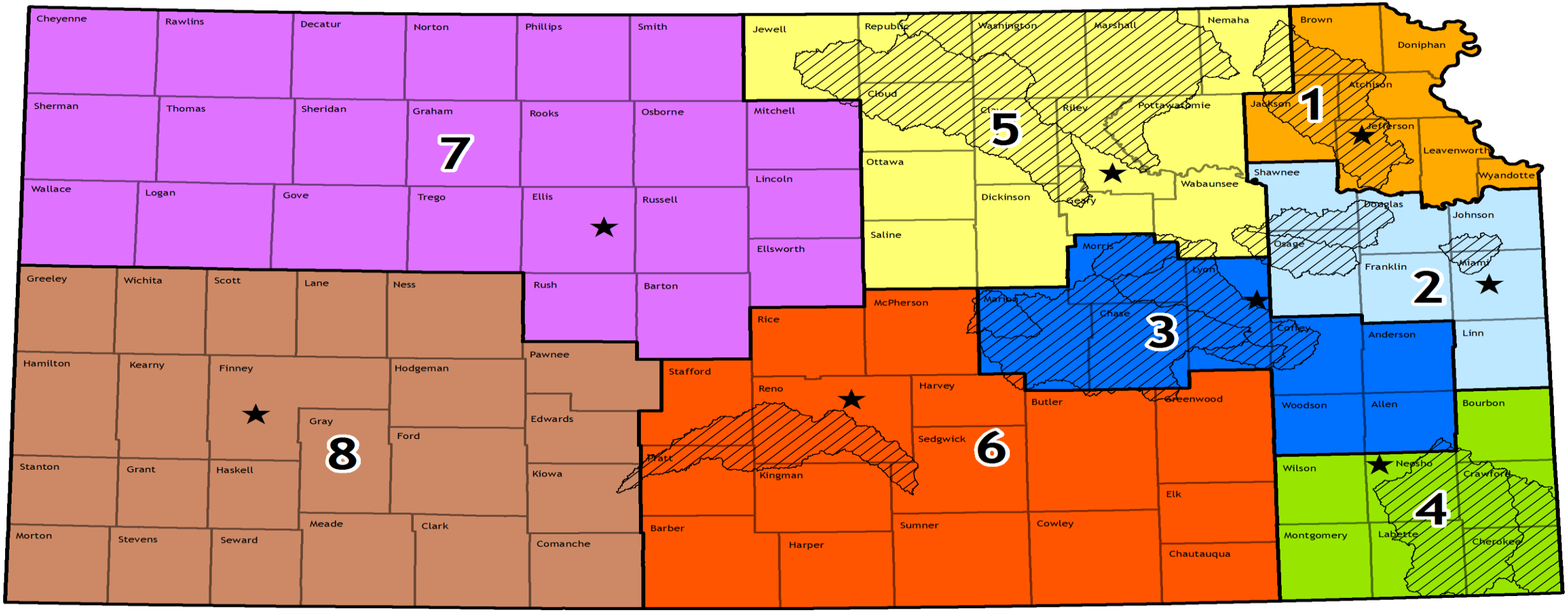


Figure 72—Estimated carbon stocks on forest land, by forest-type group and carbon pool per acre, Kansas, 2006-2010.

What this Means……

- ❑ Forest carbon is in young stands of long-lived species
- ❑ Carbons stocks are projected to increase
- ❑ Tree planting and different approaches to forest management and windbreaks can increase storage and sequestration

Kansas Forest Service Districts, Foresters and RCPP Watersheds



1 – Ryan Rastok, Oskaloosa **2 – Katy Dhungel,** Paola **3 – Howard Freerksen,** Reading
4 – Ashley Stiffarm, Chanute **5 – Thad Rhodes,** Manhattan **6 – Chris Mullins,** Hutchinson
7 – Jami Seirer, Hays **8 – John Klempa,** Garden City

RCPP PRACTICES & PAYMENT

Conservation Practices

314—Brush Management
315—Herbaceous Weed Control
338—Prescribed Burning
342—Critical Area Planting
380—Windbreak/Shelterbelt Establishment
382—Fence
390—Riparian Herbaceous Cover
391—Riparian Forest Buffer
393—Filter Strip
394—Firebreak
472—Access Control
484—Mulching
490—Tree/Shrub Site Preparation
512—Forage & Biomass Planting
550—Range Planting
595—Integrated Pest Management
612—Tree/Shrub Establishment
660—Tree/Shrub Pruning
666—Forest Stand Improvement

Cost-Share Components (not all listed)

Mechanical Mowing	$11.62/AC
Herbicides (banding)	$31.06/AC
Weed Barrier Fabric (sq)	$1.79/EA
Mechanical Tree Establ	$151.56/AC
Tree/Shrub Site Prep (med)	$212.72/AC
Tree/Shrub Site Prep (heavy)	$240.54/AC
Direct Seeding	$741.19/AC
Tree Planting (Mach & Tubes)	$7.20/EA
Tree Planting (Hand/Tubes)	$4.07/EA
Tree Planting (Machine)	$2.14/EA
Riparian Forest Buffer Cont	$1,809.32/AC
Riparian Forest Buffer B Root	**$1,125.74/AC**
Barbed Wire Fence (multi)	$1.31/LnFt
Forest Stand Improvement	**$253.58/AC**
Competition Control, Heavy	$389.22/AC
Thinning for Wildlife	$732.32/AC

Additional WRAPS Funding will cover 90% of costs