Opportunities for Enhancement through Responsible Forest Management –

Examples from the Fernow Experimental Forest

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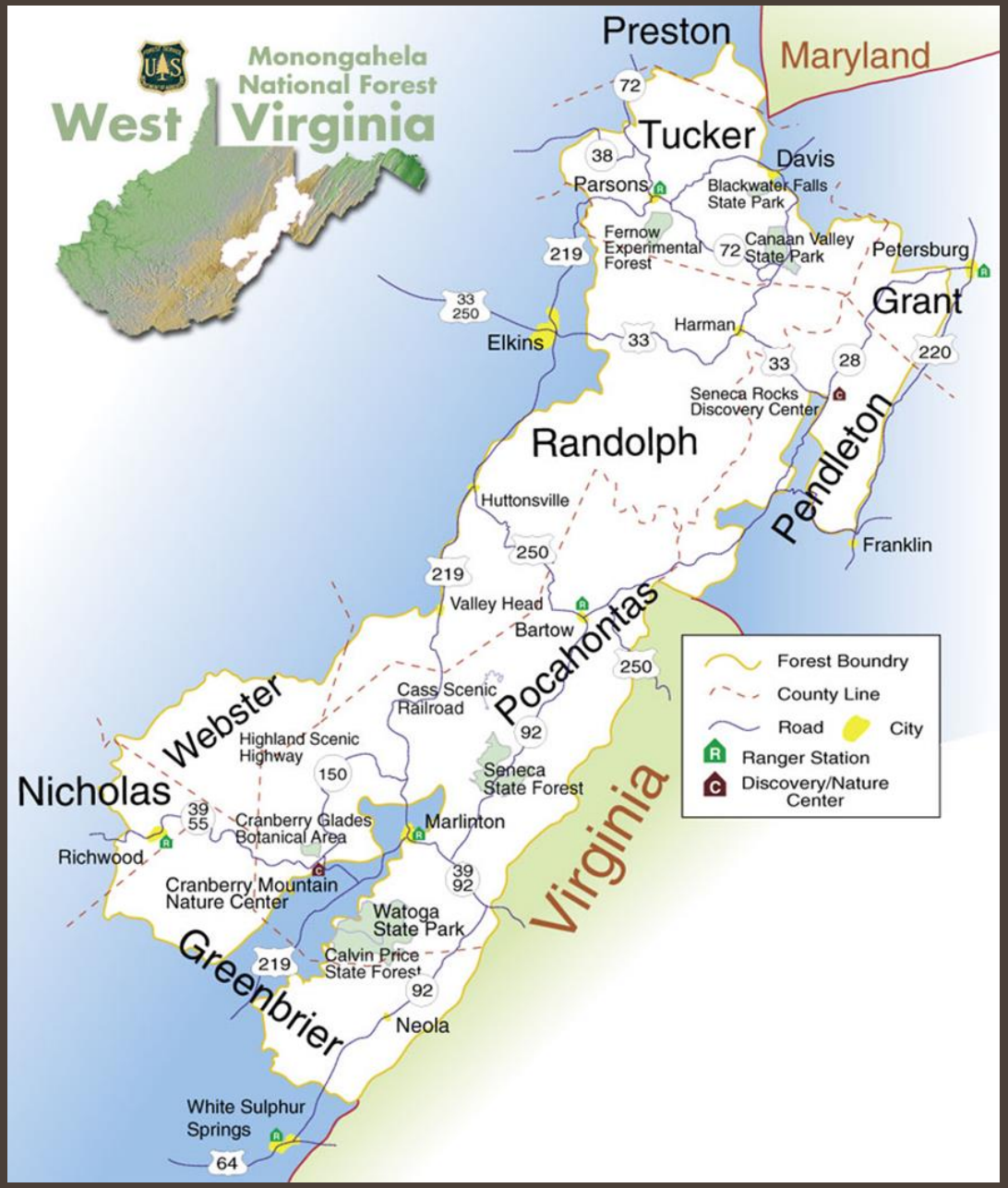
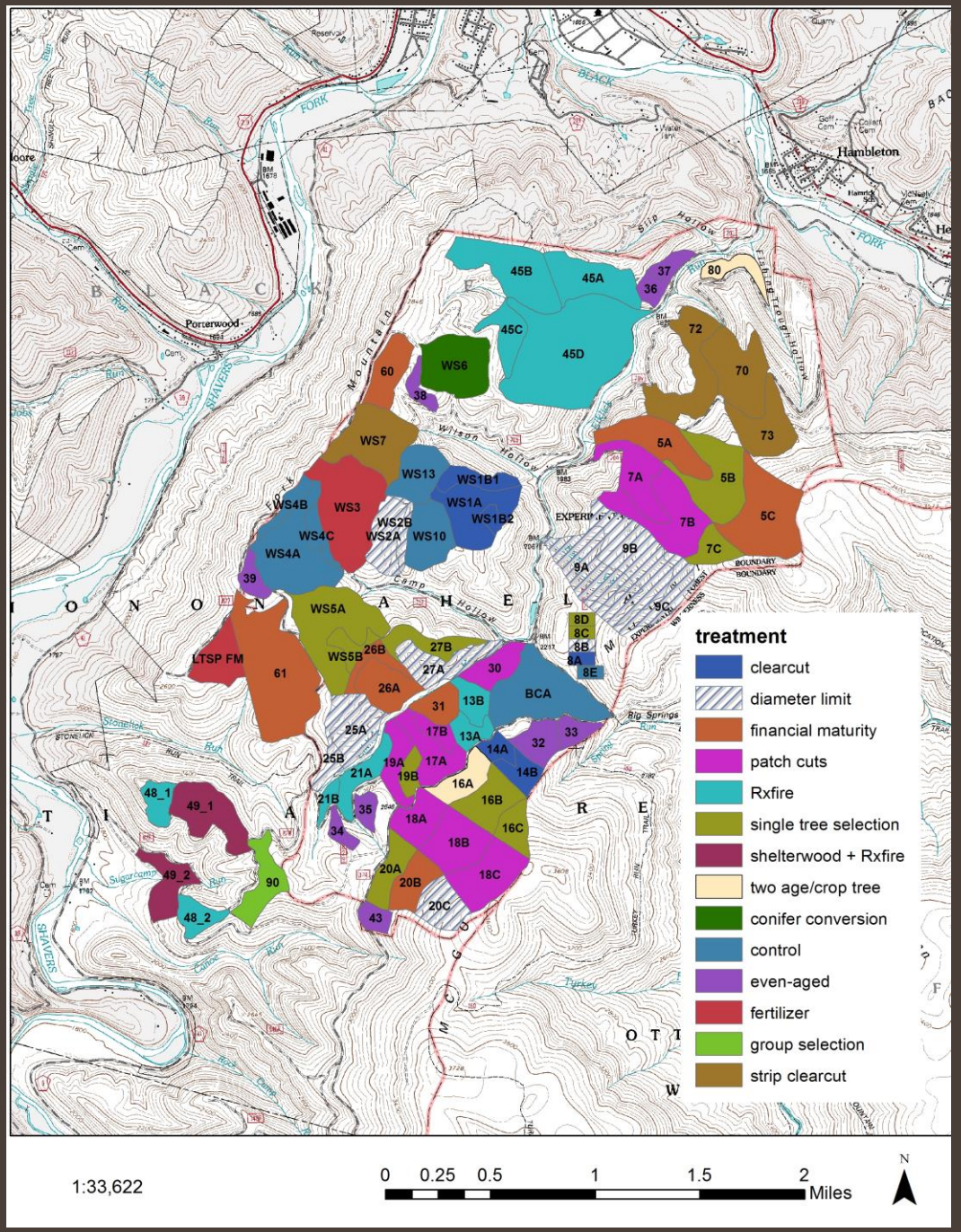

Monongahela
National Forest
West Virginia
Preston
Maryland
72
Tucker
38
Davis
Parsons
Blackwater Falls
State Park
Fernow
Experimental
Forest
219
72
Canaan Valley
State Park
Petersburg
Grant
33
250
Elkins
Harman
33
33
28
220
Seneca Rocks
Discovery Center
Randolph
Pendleton
Huttonsville
250
Franklin
219
Valley Head
Bartow
Pocahontas
250
Webster
Cass Scenic
Railroad
92
Highland Scenic
Highway
150
Seneca
State Forest
Nicholas
39
55
Cranberry Glades
Botanical Area
Marlinton
Richwood
Cranberry Mountain
Nature Center
39
92
Virginia
Watoga
State Park
Greenbrier
219
Calvin Price
State Forest
92
Neola
White Sulphur
Springs
64
Forest Boundry
County Line
Road
City
Ranger Station
Discovery/Nature
Center

established 1934, research began in 1949

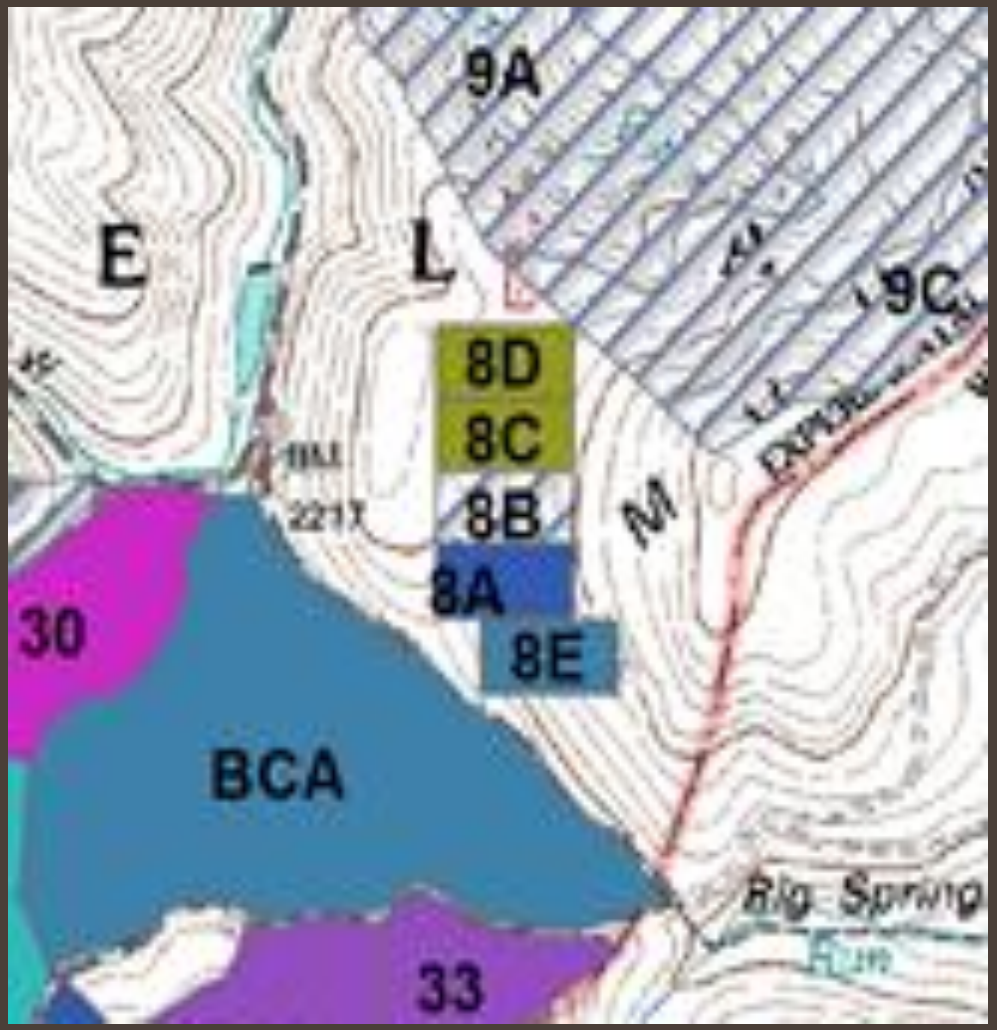
~5,000 ac



Species mix on the Fernow

- Yellow-poplar
- Beech
- Black birch
- Yellow birch
- Sugar maple
- Red maple
- Northern red oak
- White oak
- Chestnut oak
- Hickories
- White ash
- Black cherry
- Basswood
- White pine
- Hemlock
- Black walnut
- Black locust

Some research results

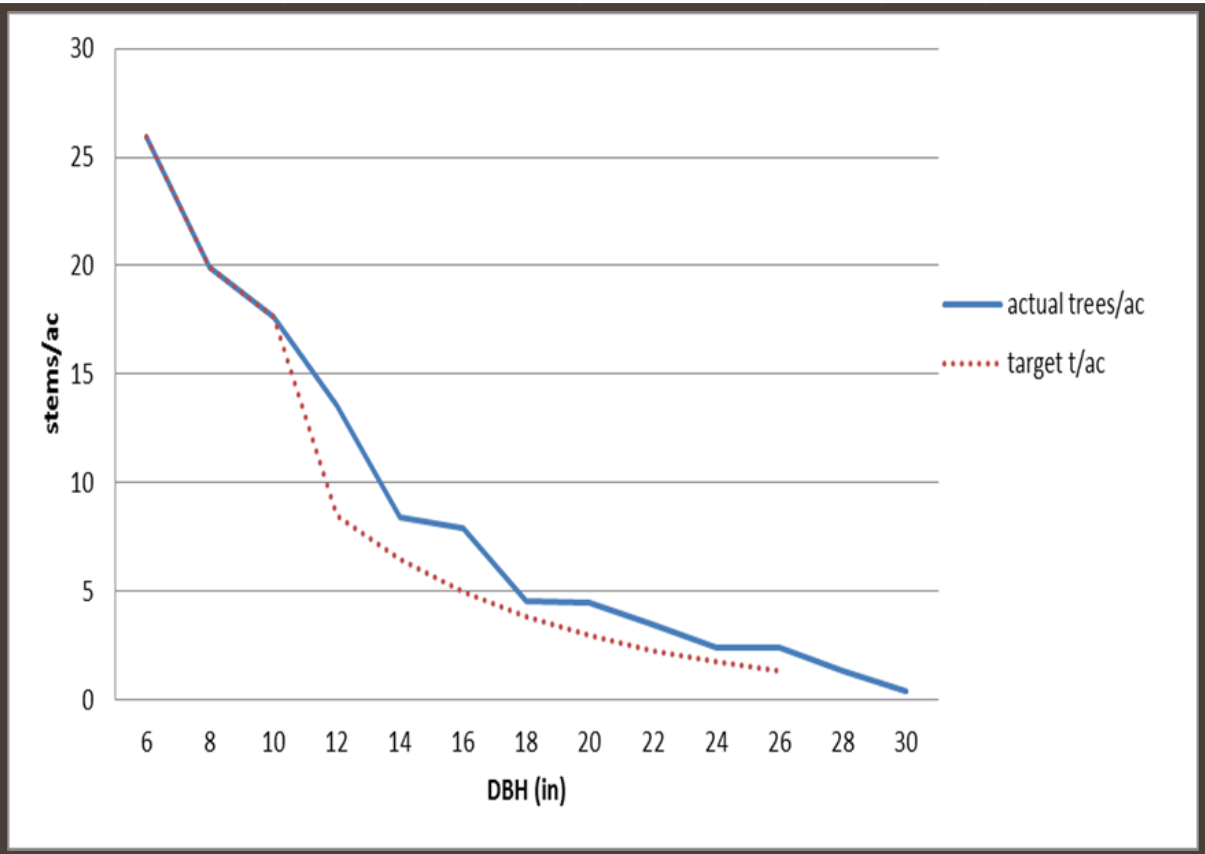


Long-term cutting practices study (initiated 1949)

- Excellent
  - Intensive single-tree selection
- Good
  - Extensive single-tree selection
- Fair
  - Diameter-limit
- Poor (exploitive)
  - Commercial clearcut
- Reference
  - Unmanaged – added 1956

Treatments

Cutting practice	Cutting cycle (yrs)	RBA (ft2/ac)	Largest DBH retained (in)	Q	Min DBH (in)
Excellent (SP)	5-10	85	32	1.3	5.0
Good (ST)	10	70	32	1.3	11.0
Fair (DL)	20		16		15.5
Poor (CC)	70-80				5.0



Original Objectives

- Demonstrate effects of silvicultural practice:
  - Species composition
  - Growth and yield
  - Quality
  - Regeneration
- 5-acre units set up for demonstration purposes
  - Includes signage and easily accessible terrain with trail

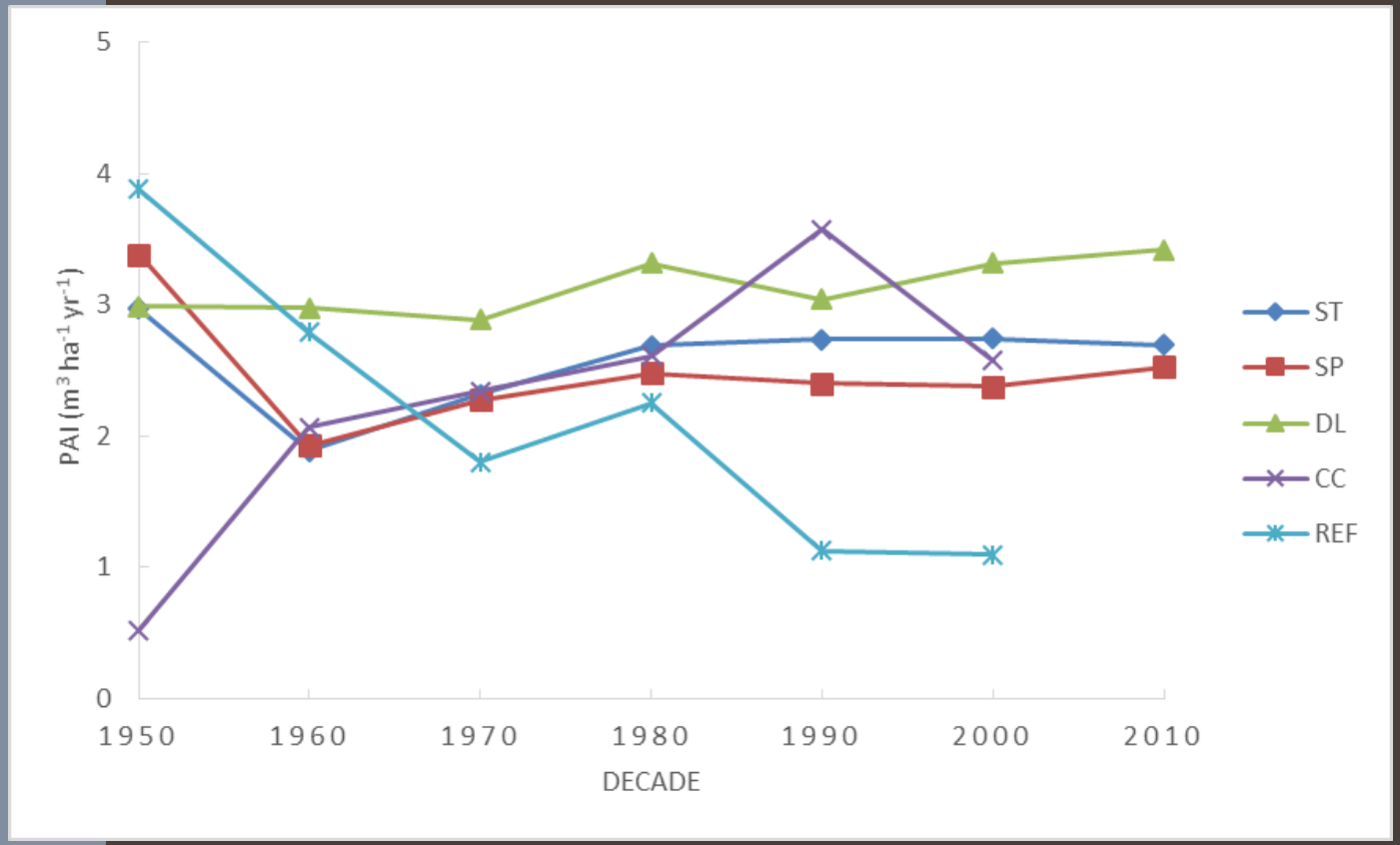
Zero Grade Trail

Results

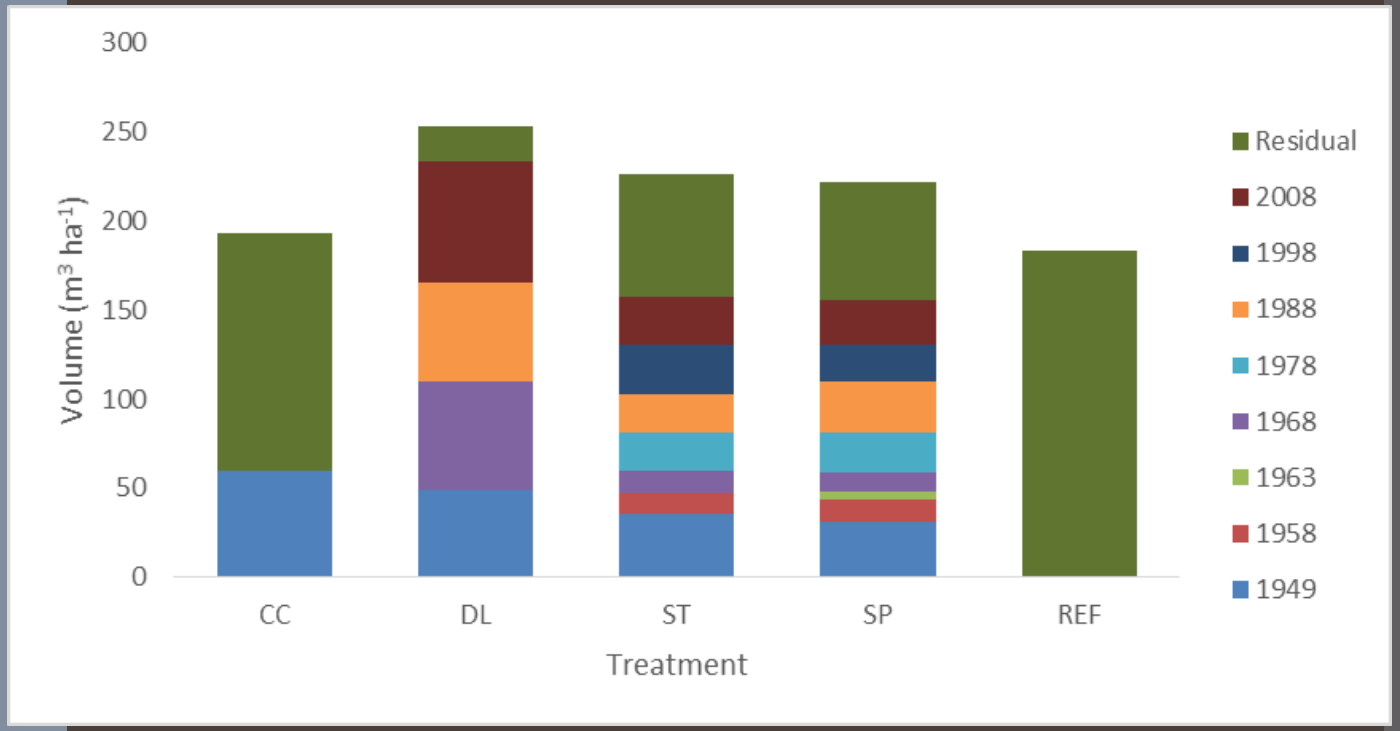
- Volume
  - Periodic Annual Increment
  - Total volume
- Tree quality
- Species composition
  - Diversity
  - Shade tolerance
  - Hard mast producers

Schuler, T.M.; Thomas-Van Gundy, M.; Brown, J.P.; Wiedenbeck, J.K. 2017. Managing Appalachian hardwood stands using four management practices: 60-year results. Forest Ecology and Management. 387: 3-11. https://doi.org/10.1016/j.foreco.2016.08.019

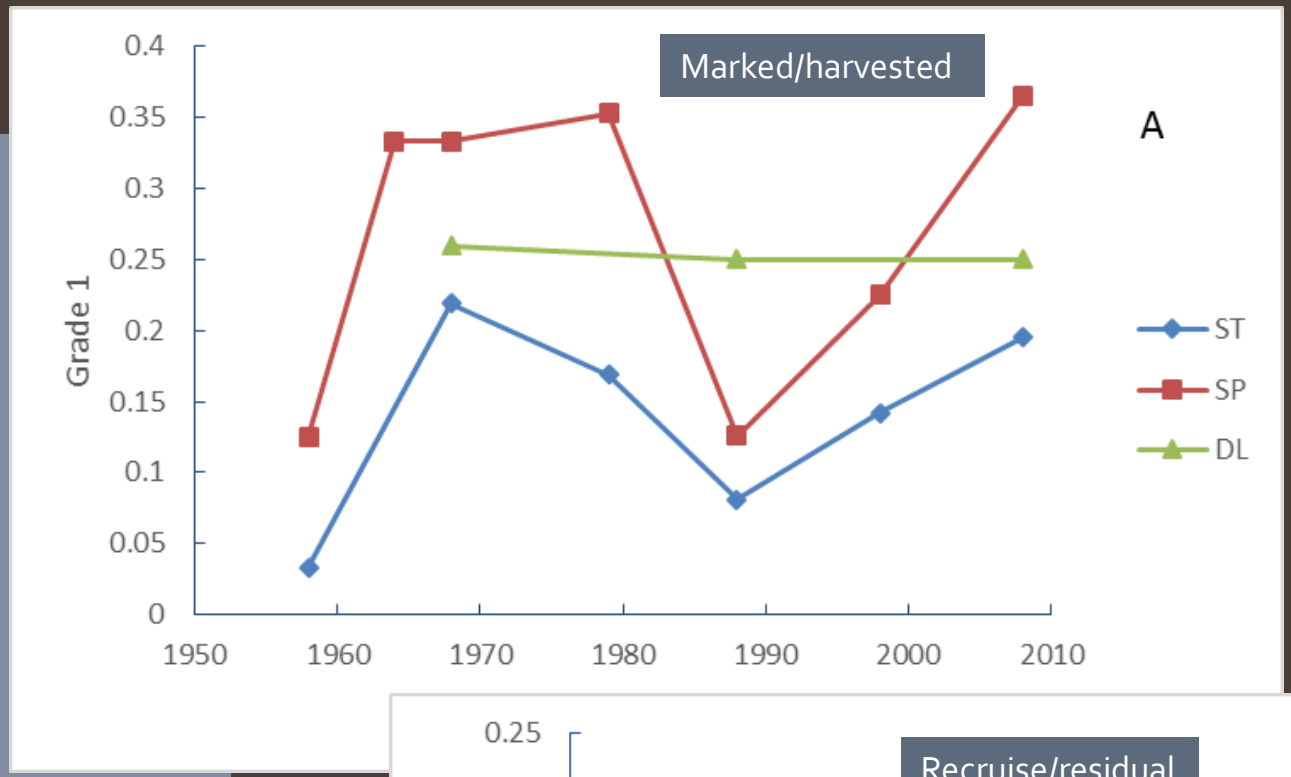
Periodic Annual Increment

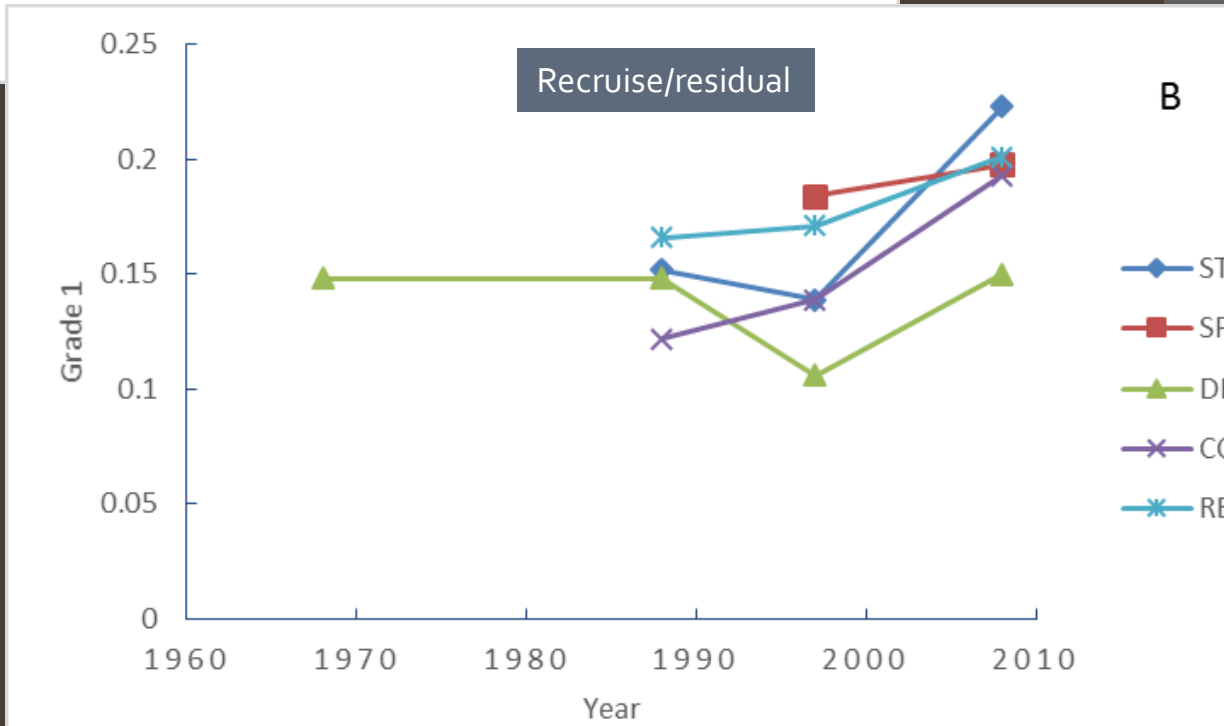


Total Volume (harvest + residual)

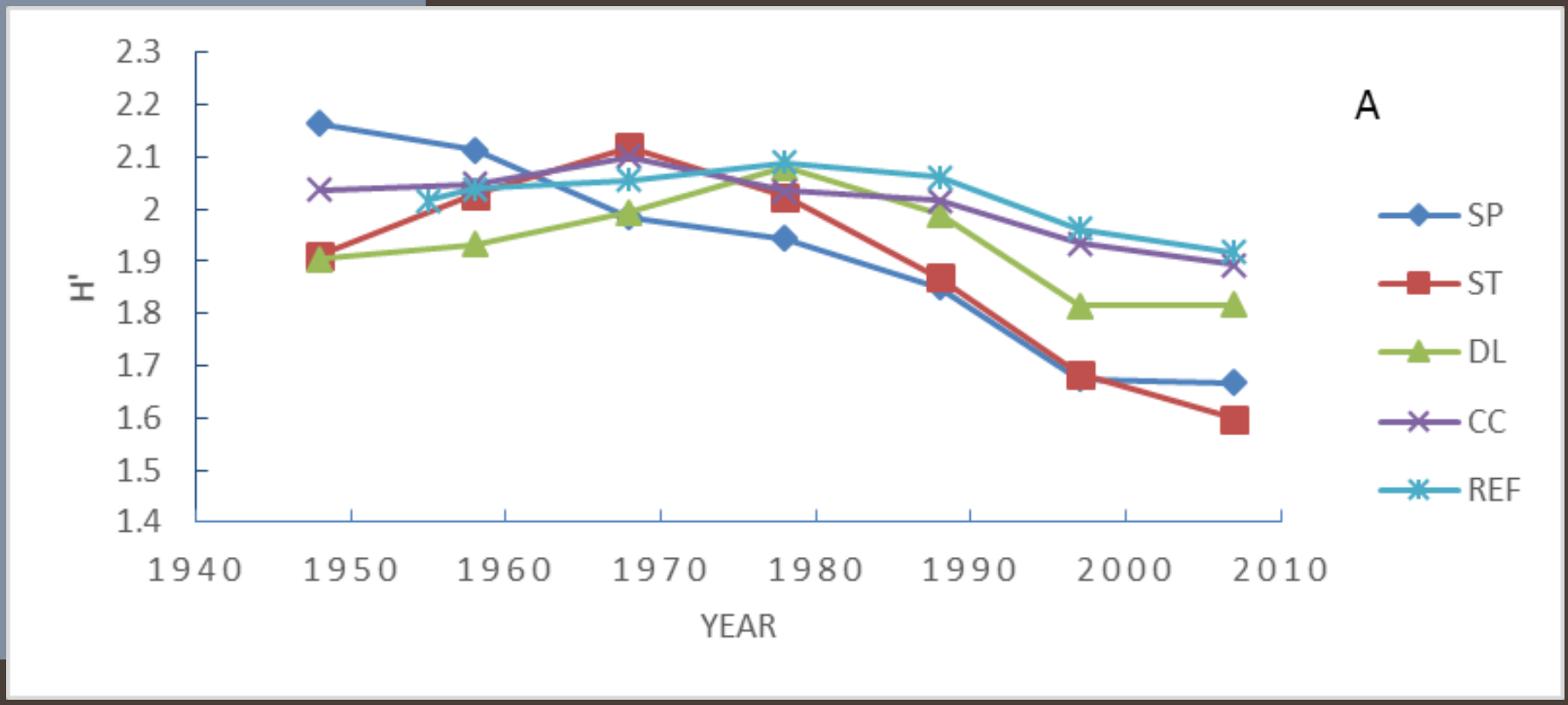


Quality

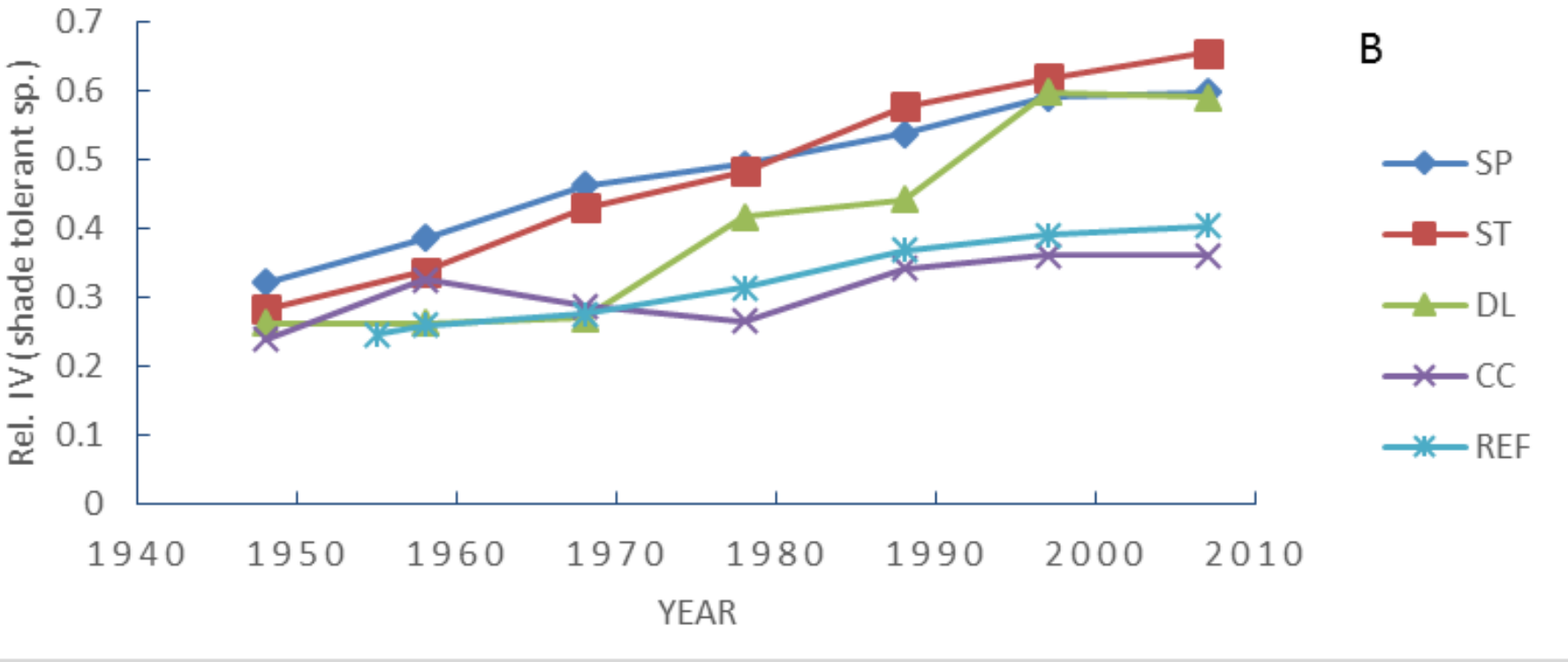

Marked/harvested
A
Grade 1
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1950
1960
1970
1980
1990
2000
2010
ST
SP
DL


Recruise/residual
B
Grade 1
0.25
0.2
0.15
0.1
0.05
0
1960
1970
1980
1990
2000
2010
Year
ST
SP
DL
CO
RE

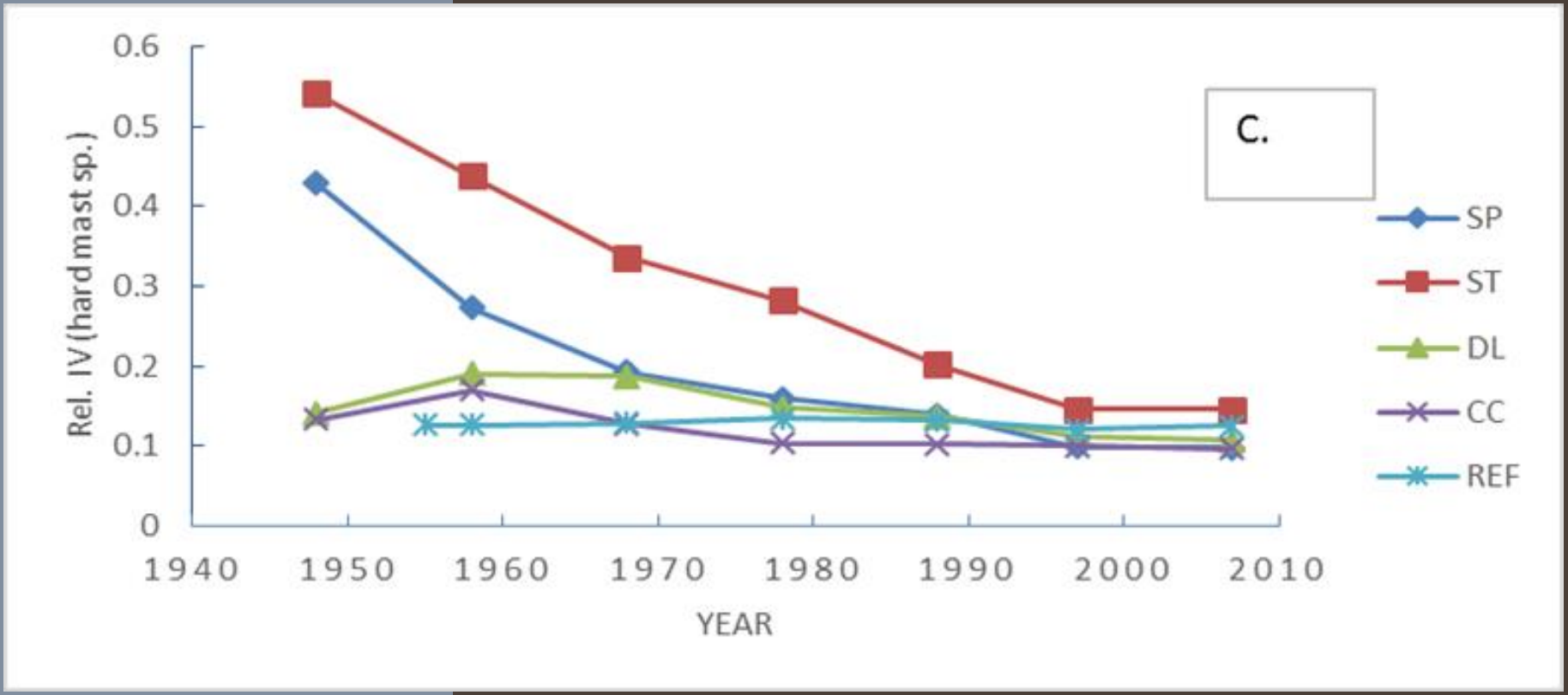
Diversity (H')


A
H'
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1940
1950
1960
1970
1980
1990
2000
2010
YEAR
SP
ST
DL
CC
REF

Shade Tolerant Sp.



Hard Mast (IV)


C.
Rel. IV (hard mast sp.)
0.6
0.5
0.4
0.3
0.2
0.1
0
1940
1950
1960
1970
1980
1990
2000
2010
YEAR
SP
ST
DL
CC
REF

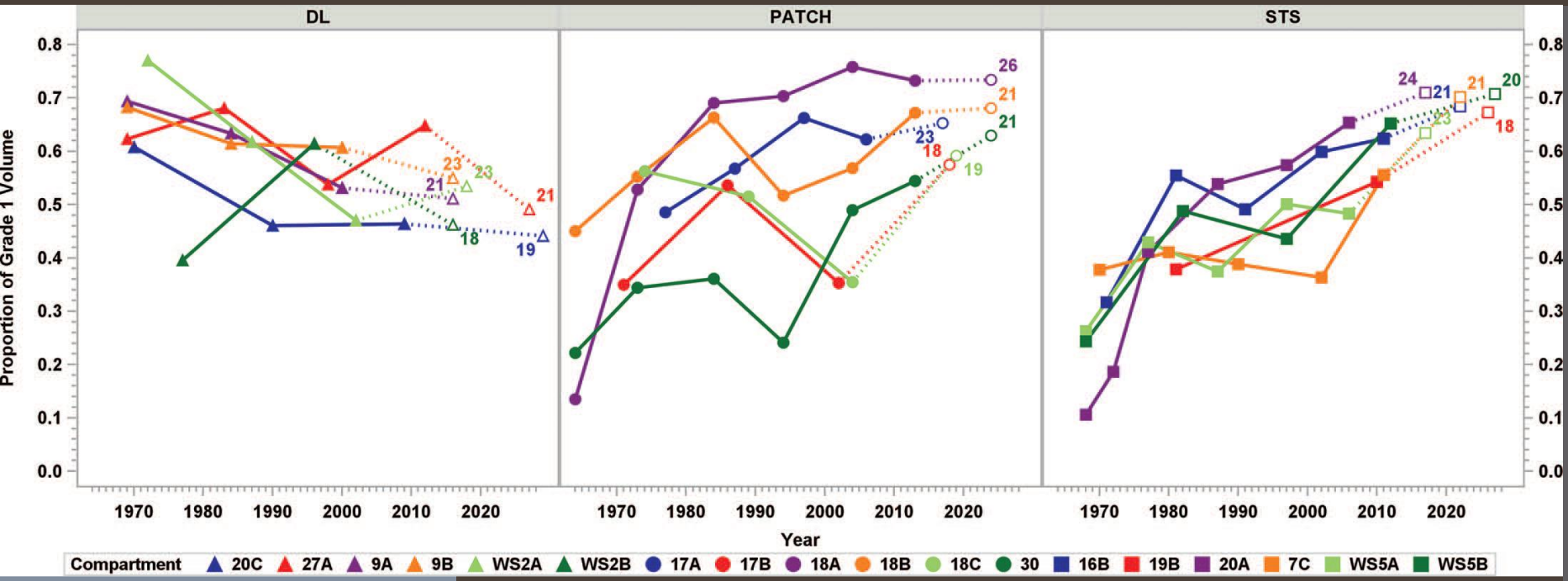
Conclusions

- Tree diversity declining in all harvest areas, slowest in the CC
- Present value - greatest in the single tree
- Diameter-limit leading to declining productivity

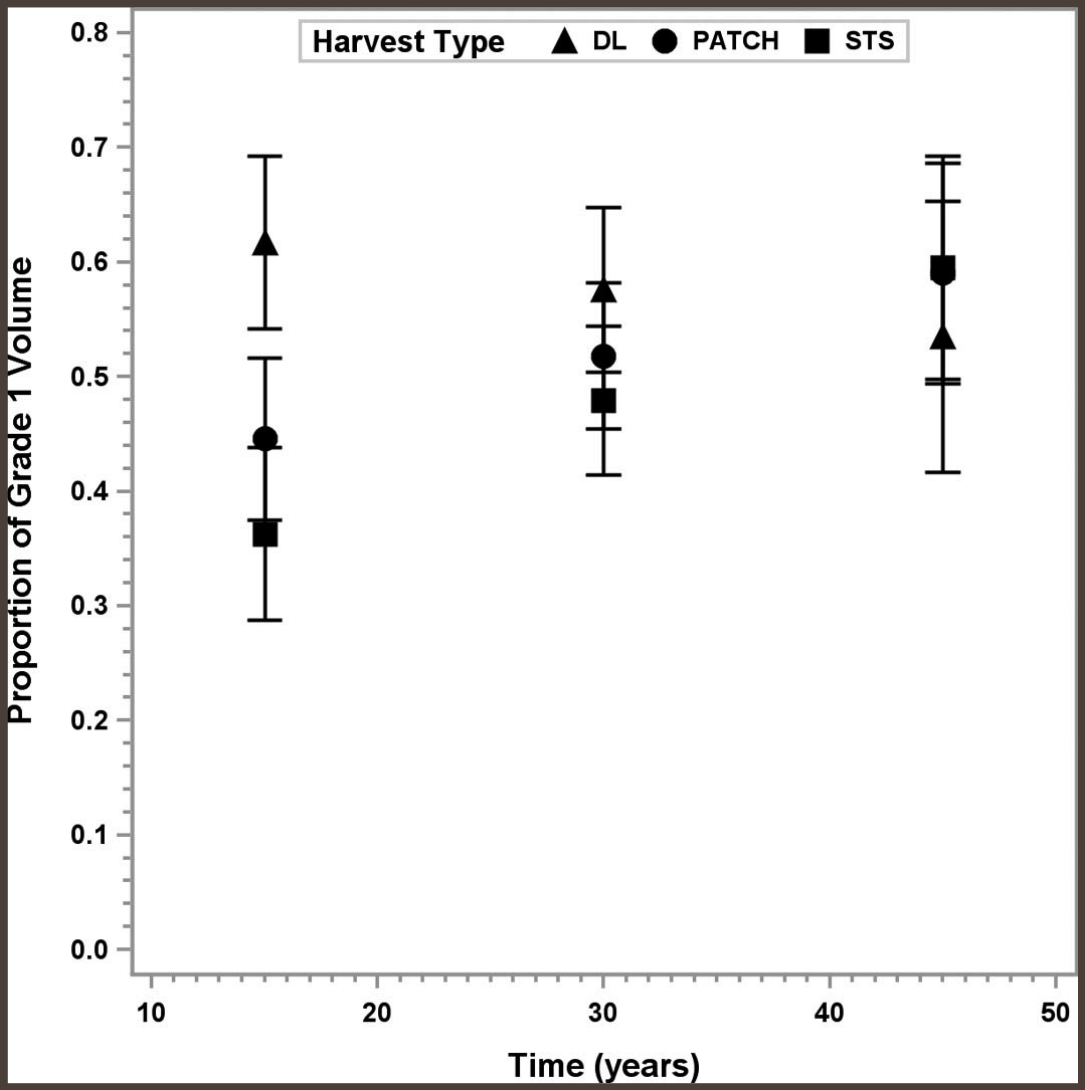
Large Area Comparison of Forest Management Practices

- Silvicultural practice * site quality
  - Red oak SI
    - Excellent: 80 50 yrs
    - Good: 70 50 yrs
    - Fair: 60 50 yrs
- Silvicultural practices
  - Single-tree selection
  - Diameter-limit
  - Patch clearcut
  - Unmanaged reference (controls)

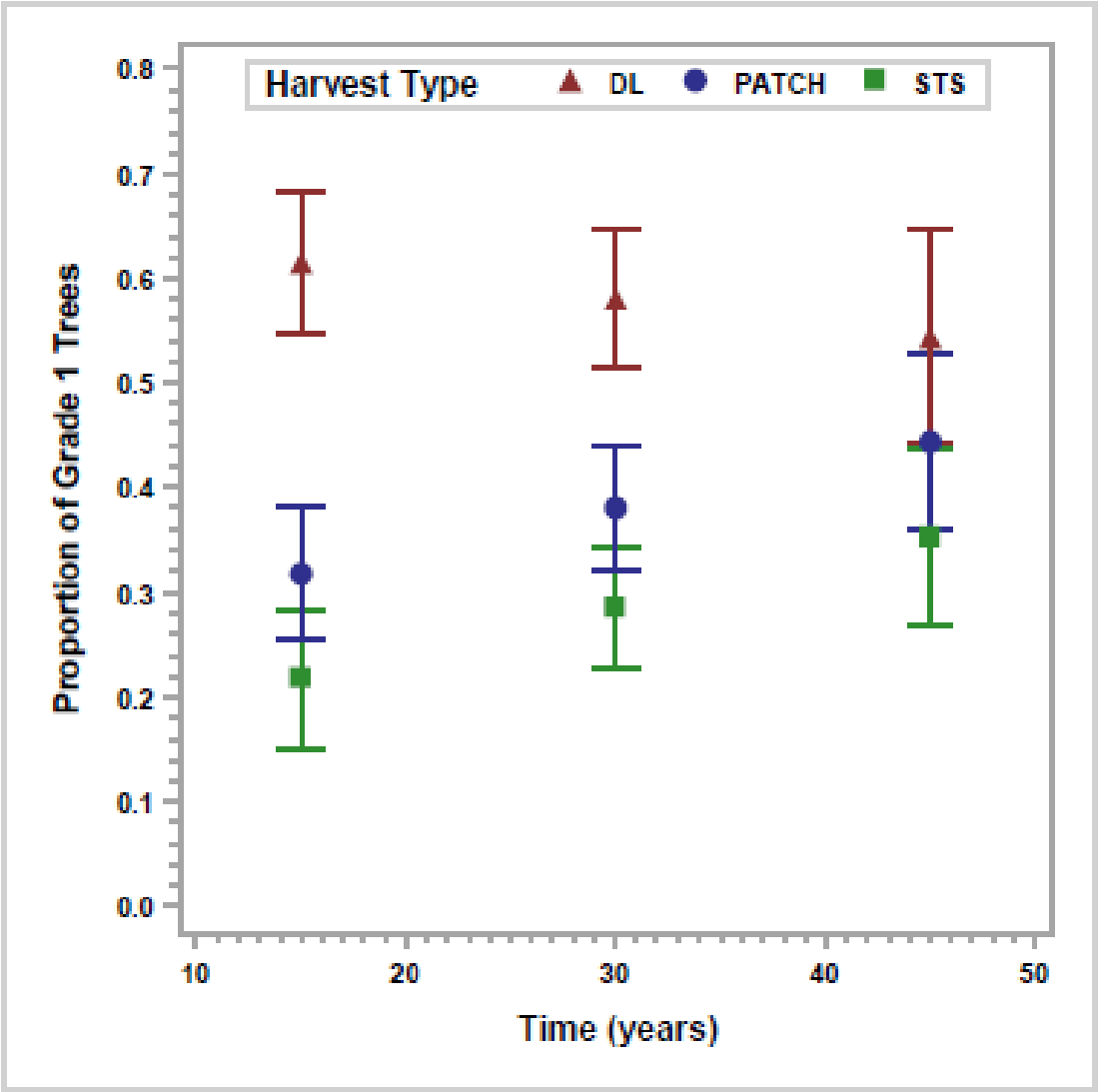
Quality



Percentage of grade 1 volume removed over time and by harvest type



Note DL declined and STS increased


Harvest Type
DL
PATCH
STS
Proportion of Grade 1 Trees
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
10
20
30
40
50
Time (years)

Conclusions

- Diameter-limit harvest decreased proportion of grade 1 butt logs
  - Projecting future shows maintaining high grade logs unstainable
- Grade 1 butt logs increase with patch cutting and single tree selection
  - Projecting future shows grade sustainable under single tree selection
  - Sustainability uncertain under patch cutting

Back to basics of forestry – they work!

- Density, relative or absolute
- How much stuff you remove over what length of time
- Take the bad stuff first – remember AGS and UGS?
- Every entry is an opportunity to leave the stand better than you found it
- Shade tolerance matters – still have some issues with sustaining oak on these sites

sources

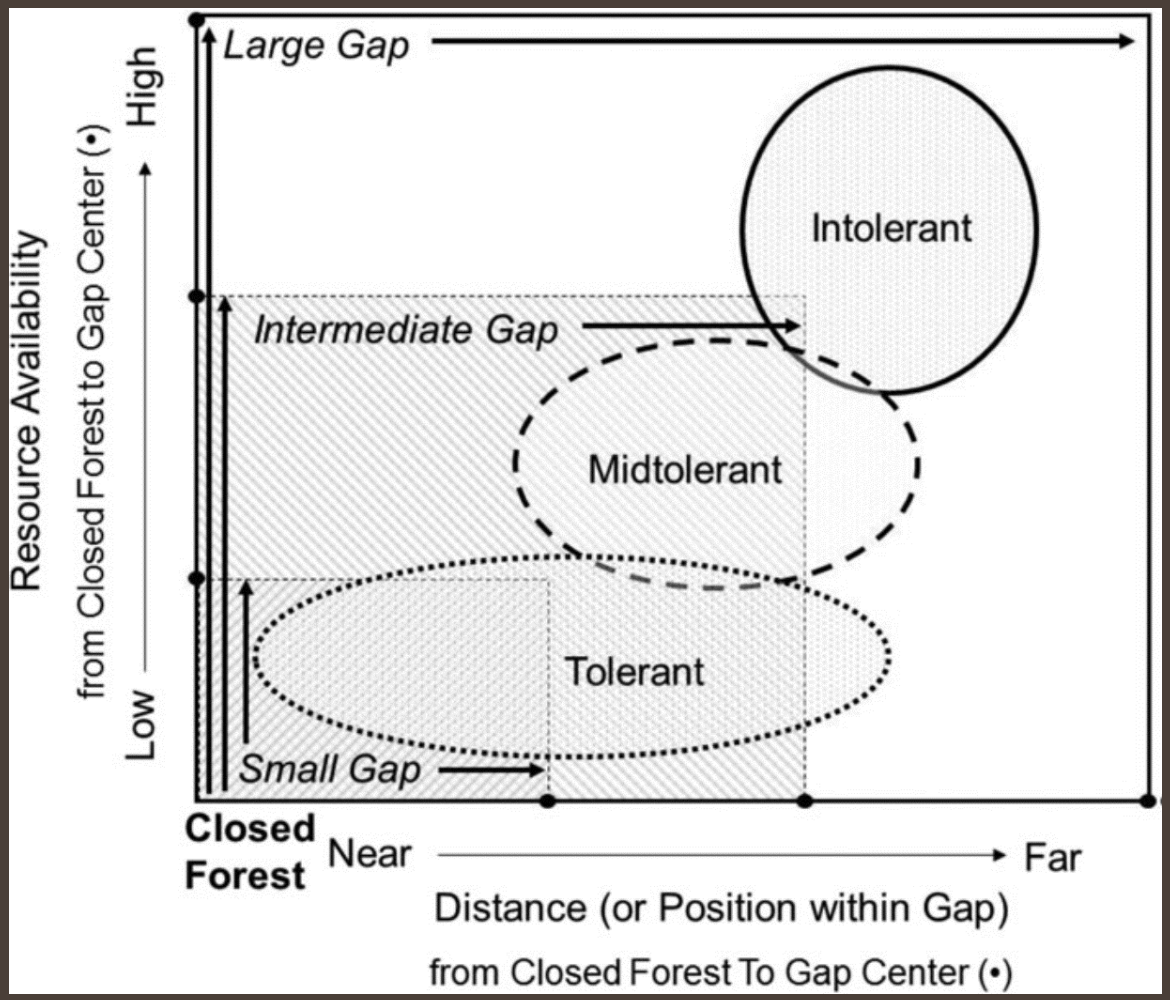
- Schuler, T.M.; Ford, W.M.; Adams, M.B.; Kochenderfer, J.N.; Edwards, P.J. 2006. Large area comparisons of forest management practices in West Virginia (1951-present). In: Irland, L.C.; Camp, A.E.; Brissette, J.C.; and Donohew, Z.R., eds. Long-term Silvicultural & Ecological Studies: Results for Science and Management. New Haven, CT: Yale University: 94-103
- Brown, J.P.; Thomas-Van Gundy, M.A.; Schuler, T.M.; Wiedenbeck, J.K. 2018. Silvicultural Prescriptions Influence the Proportion of High-Quality Hardwood Butt Logs Harvested over a Half-Century of Management. Forest Science. 64(2): 203-213. https://doi.org/10.5849/FS-2016-123.

Challenges facing gap-based silviculture and possible solutions for mesic northern forests in North America

Kern, C. et al. 2017. Forestry, 90, 4–17, doi:10.1093/forestry/cpw024

Gap-based silviculture for species diversity

Factors that limit success



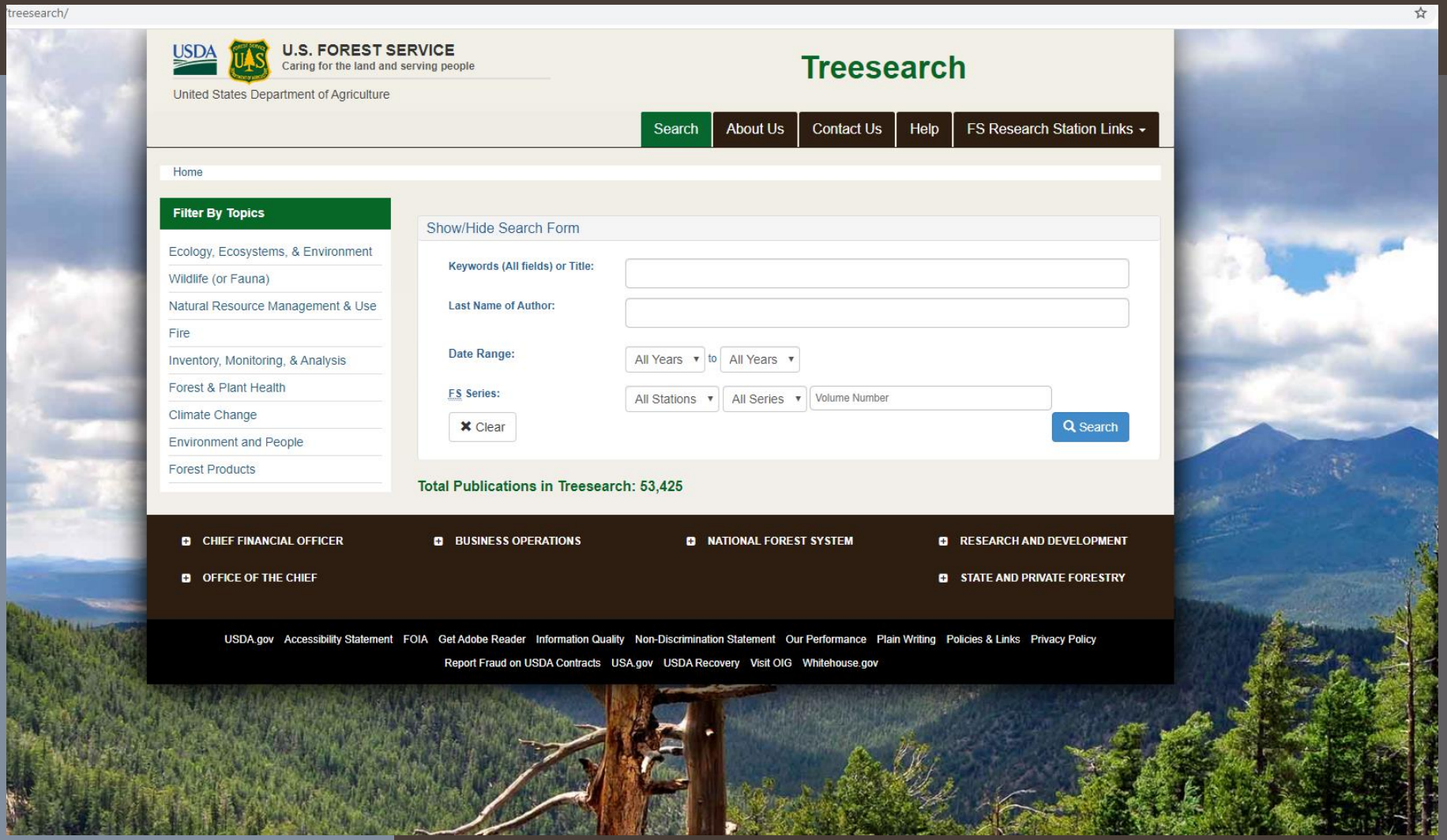
Challenges

impact the predicted trajectory

- Lack of advanced regen
- Species available not suited to gap regen (light levels too low)
- Responses of native invaders – beech brush, blackberry
- Response of non-native invasive plants
- Deer browse

Differences between managed and natural gaps

- Tip up mounds
- Bare soil
- Woody debris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