

Browsing trends of white-tailed deer (*Odocoileus virginianus*) and impacts on Atlantic white cedar restoration

Jacqueline D. Roquemore¹, David Norris², and
Robert B. Atkinson¹

¹Center for Wetland Conservation at Christopher Newport University
and

²Virginia Department of Game and Inland Fisheries

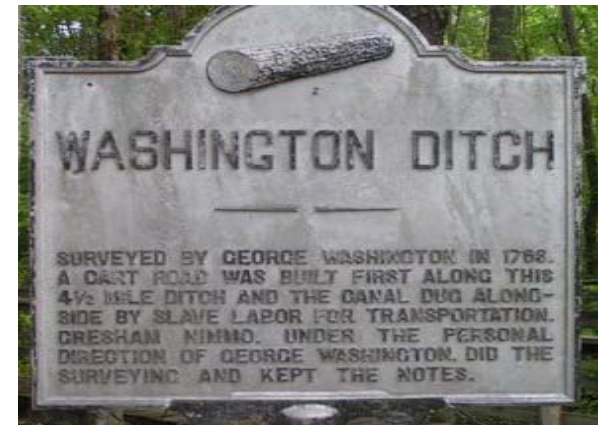
Atlantic white cedar (AWC) natural history

- ❑ grows in monotypic stands
- ❑ found in Coastal Plain swamps
- ❑ native range from southern Maine to northern Florida
- ❑ considered a globally threatened ecosystem



Historical and existing impacts

- logging
 - hydrologic alteration
 - conversion to agriculture
- urgent need for restoration



AWC restoration

- often involves planting of AWC seedlings
- attempts to increase seedling success
 - reduce competing vegetation
 - decrease herbivory



White-tailed deer (*Odocoileus virginianus*)

- highly abundant mammal in North America
- herbivore
 - browser
 - eats tips off twigs and shrubs
 - feeds on seasonally available vegetation
 - in winter feeds on buds and twigs of woody vegetation



Problems associated with herbivory

- deer browse
 - causes changes in stem morphology
 - reduces growth
 - can result in tree mortality
- deer influence success and type of species found in a forest (Van Deelen et al., 1996)



White-tailed deer (*Odocoileus virginianus*)

- commonly found on restoration sites
- preferred habitat
 - forests
 - swamps
 - open brushy areas nearby



Removal of competing vegetation

- competitor removal creates patchy habitat preferred by deer
- a regeneration study of northern red oak (*Quercus rubra*) identified effects of competitor removal and deer browse
 - in uncut plots
 - mortality was low
 - growth was poor
 - in clear-cut plots
 - mortality was high
 - surviving seedlings exhibited good growth
 - clear-cutting leaves target species in a vulnerable state, becoming a more likely food choice

(Buckley et al., 1998)

Exclusion fencing not feasible

- in a comparison of electric fences, tree shelter tubes, wire mesh cages, and tall fences in a Pocosin Lakes NWR restoration project, none of the exclusion devices were found to be economically feasible for large planting areas (Hinesley et al., 2003)



Chemical deterrent

- capsaicin
 - from plants in the genus *Capsicum*
 - active product in chili powders
 - irritant to mammals
 - lasts approx. 30 days
 - does not protect new growth
- Capsaicin based repellents reduced twig consumption on ornamental plantings in Colorado (Andelt et al., 1994)



Virginia Department of Game and Inland Fisheries (DGIF) goals for AWC

- restoration of a globally threatened habitat (AWC) and accompanying wetland function
- create contiguous block of habitat connected to Great Dismal Swamp



Purpose of the study

- for DGIF restoration site
 - quantify impact of browse pressure on planted AWC seedlings
 - identify seasonal trends in browse
 - determine optimal timing of chemical deterrent application in order to most effectively allocate resources

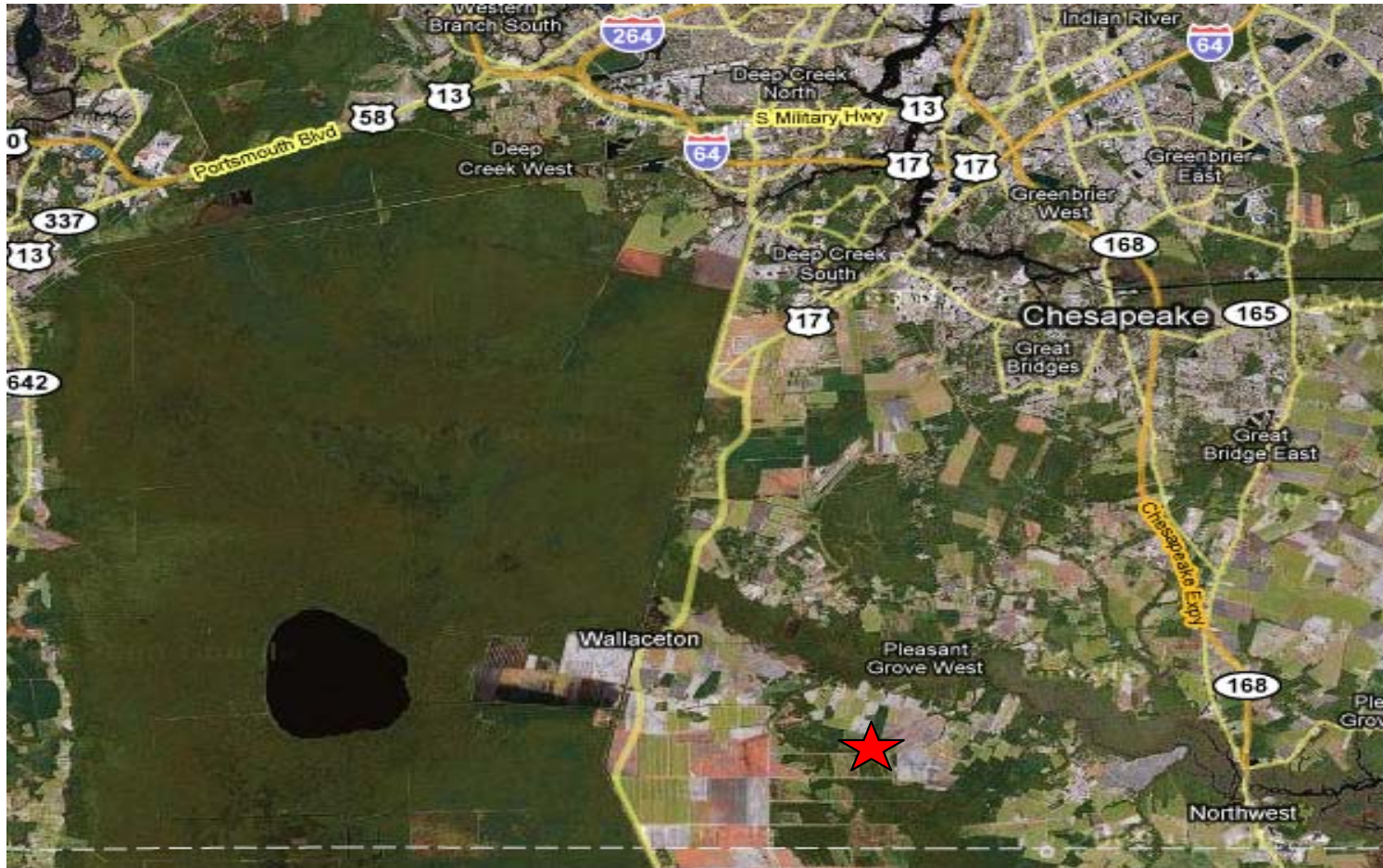


Project design and monitoring

- project was designed by DGIF
- students volunteering through the Center for Wetland Conservation at CNU provided field monitoring and analysis

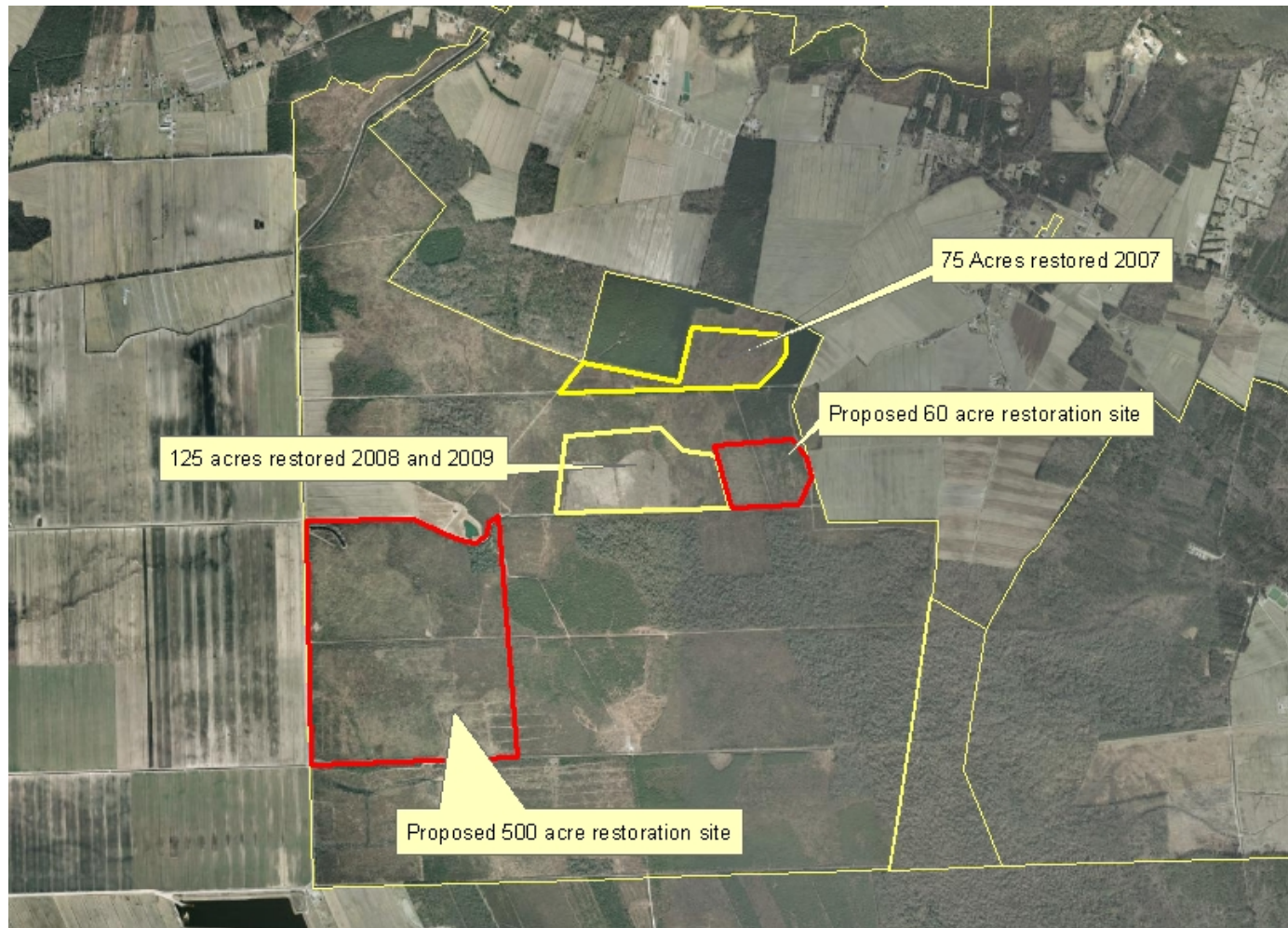


Location of restoration site



- Approximately 8 km east of Great Dismal Swamp
- Within historical range of Atlantic White Cedar

Restoration plans



Site Description

- 22 hectares
- former cutover forest land
- peat soils
- prepared for planting:
 - herbicide application in August 2007
 - drum chopping in fall 2007
- 70,000 AWC seedling planted
 - Feb 2008
 - 6 ft centers



Methods

- fencing was placed around 25 individual trees
 - 1.5m tall
 - 0.75m in diameter
 - 2”x4” mesh
- closest tree of similar initial condition was tagged

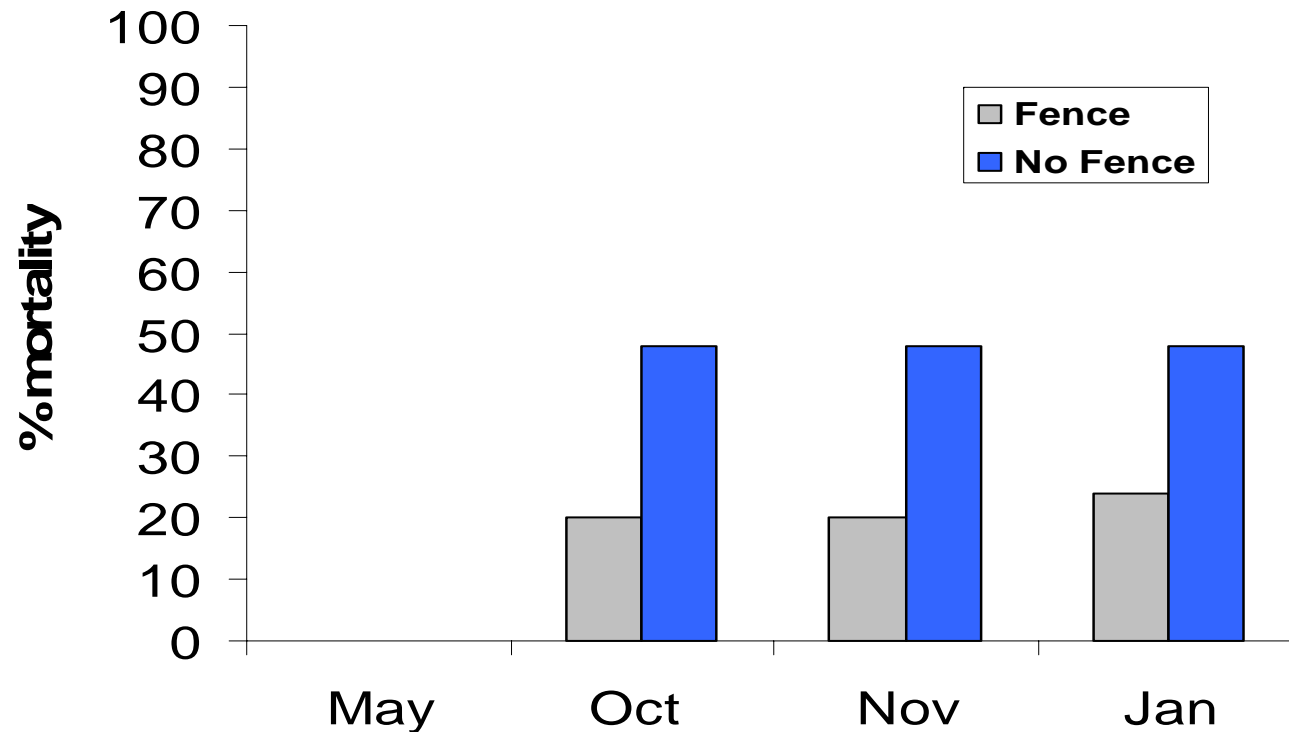


Methods

- plots established in May 2008 by DGIF and initial measurements recorded
- monitoring parameters
 - height
 - width
 - browse index
 - each tree was scored 1-5
 - 1 = no browse
 - 5 = most intense browse
- monitoring occurred
 - October 2008
 - November 2008
 - January 2009



Less mortality when deer were excluded

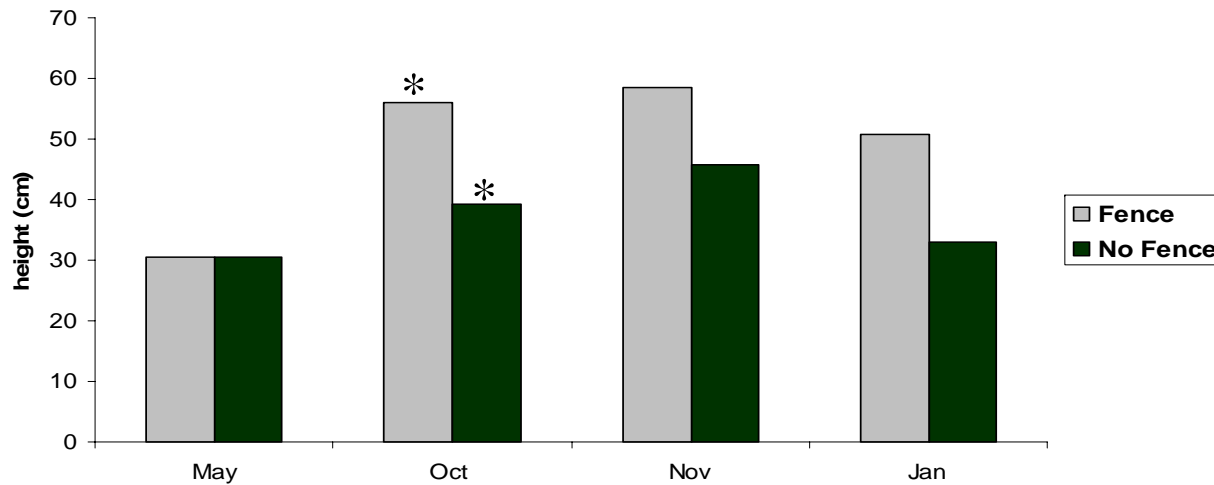


- Highest mortality occurred between May and October
- In general, trees that survived from May to October were still alive in January
- 24% of fenced trees were dead compared to 48% of unfenced trees

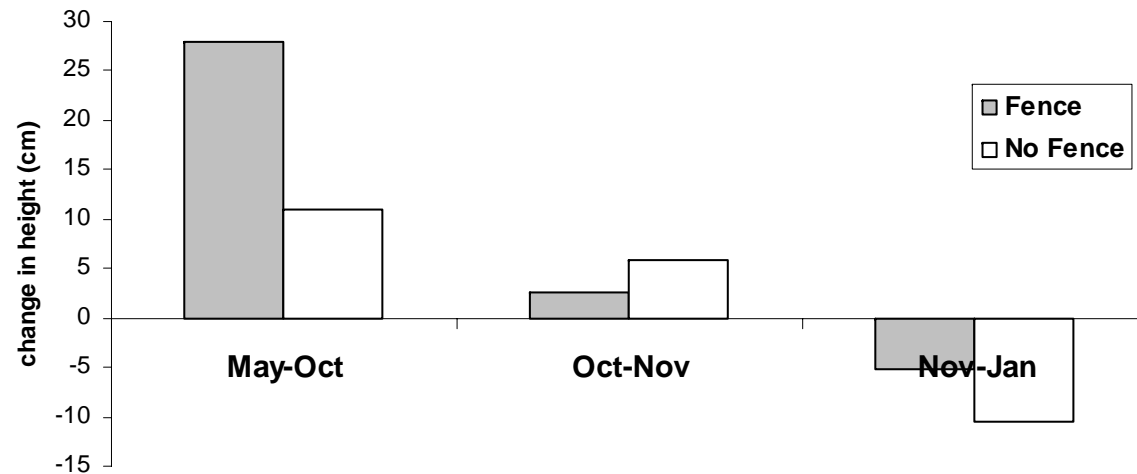
Many seedlings were completely uprooted



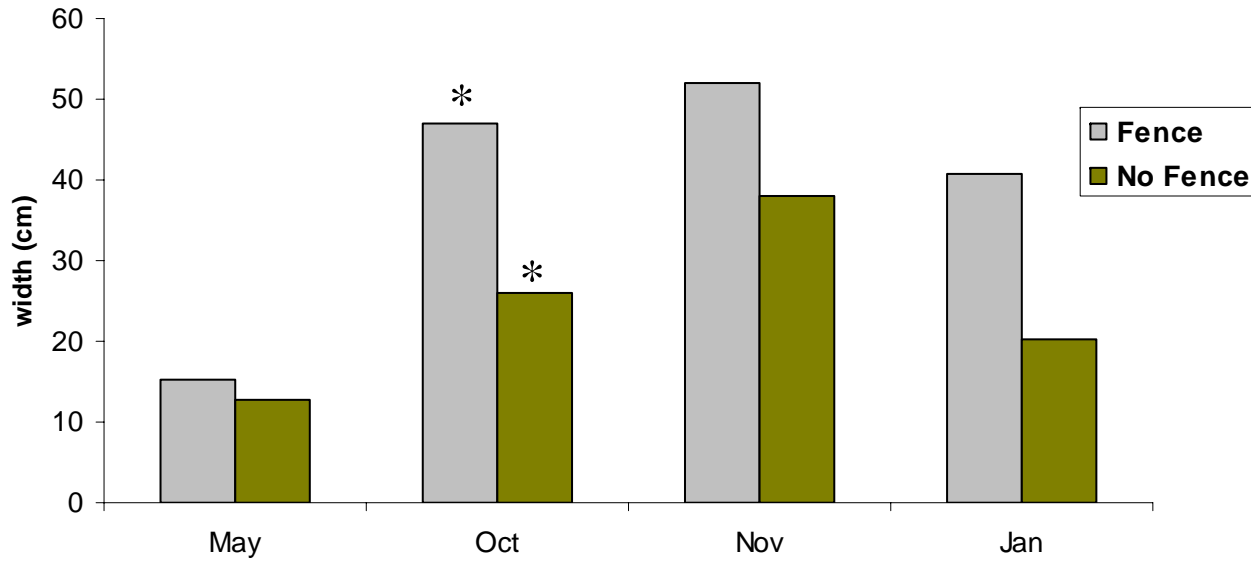
Tree height



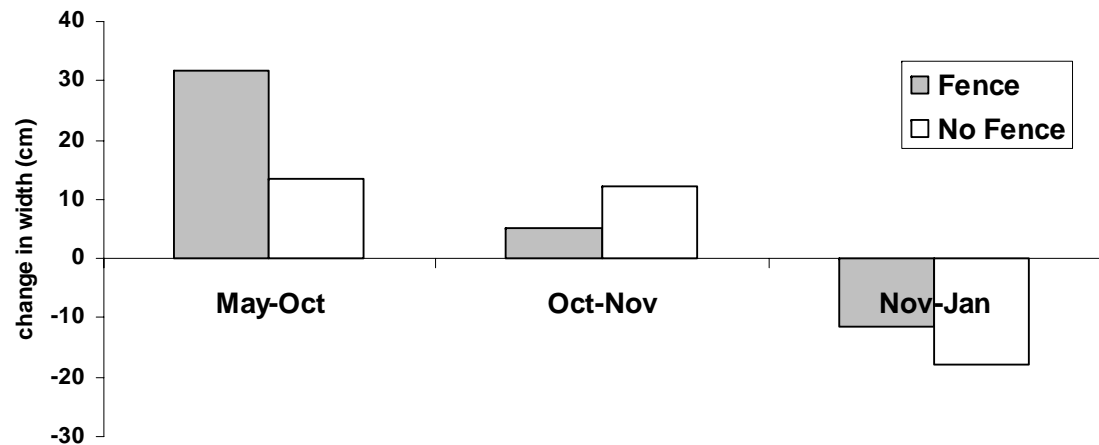
*Height of fenced trees was greater than unfenced trees in October ($p=0.035$)



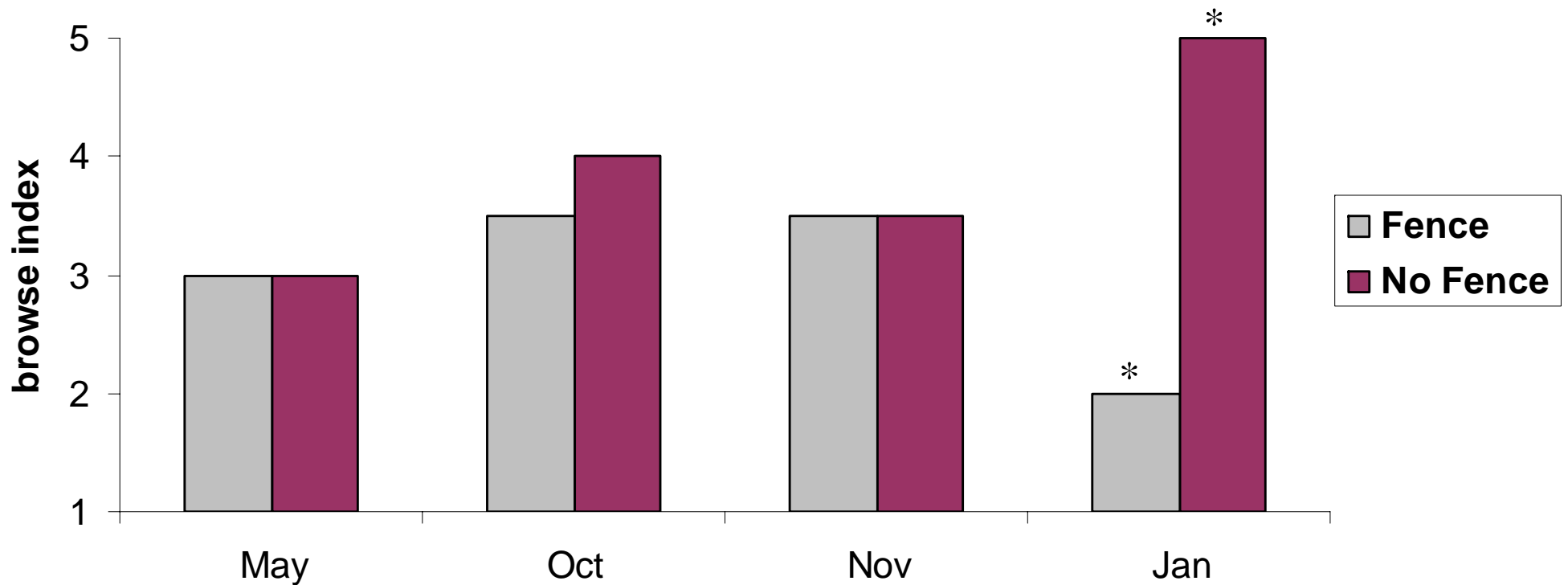
Tree width



*Width of fenced trees was greater than unfenced trees in October ($p=0.025$)



Browse intensity



- Browse intensity consistent across the monitoring periods

*Greater browse intensity on unfenced trees when compared to fenced trees in January (p=0.002)



Results summarized

- when deer were excluded
 - 24% less mortality
 - in October 16.5 cm taller
 - in October 20 cm wider
- timing of browse
 - deer exclusion in January decreased browse intensity

Discussion

- AWC mortality may have been increased by competitor removal (initial herbicidal application and clear cutting)
- reducing deer browse is beneficial to restoration efforts
 - mechanical exclusion
 - not economically feasible and not being considered
 - use of chemical deterrent
 - likely to be used by DGIF at this restoration site
 - application between May and October could decrease mortality
 - application between October and January could increase growth
 - reduction of deer population
 - DGIF supports recreation hunting on the property



Further study

- ongoing monitoring
 - once a month
 - larger sample size
- timing of herbicidal application in future restoration sites
- investigate deer impact on seedlings prior to root establishment (in months just after planting)
- proximity to forest edge

Acknowledgements

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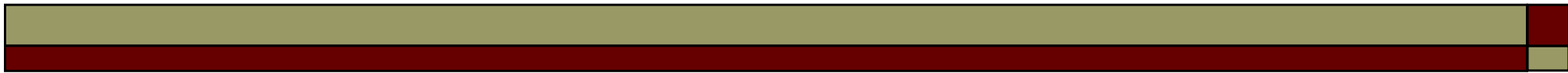


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Questions





Impacts of deer browse on forest vegetation

- research in northern Michigan
- coniferous swamps—northern white cedar (*Thuja occidentalis*)
 - compared forest composition
 - presettlement (lower deer populations)
 - present-day (higher deer populations)
 - forest species compositions have changed because of deer
 - species that are palatable to deer and intolerant to browse have decreased over time
 - mature cedar stands were established in a period of low deer population
 - deer influence success and type of species found in a forest

(Van Deelen et al., 1996)