Will Shelterwood Harvest Intensity Influence Wild Ginseng Abundance in Northern Vermont Hardwoods?

Mariah Choiniere & Pat Gourley, Rubenstein School of Environment and Natural Resources, University of Vermont

Background:

American Ginseng (Panax quinquefolius L.) is an economically valuable understory plant with a large geographical range in the Eastern United States. Historically, populations of American Ginseng have extended from Northern Georgia to Southern Quebec, and as far west as Minnesota. Due to high demands in Asia's traditional medicine markets, American Ginseng has been North America's most frequently harvested wild plant for two centuries. High harvest and export intensities led to the eventual listing to Appendix II of CITES in 1975. Because of this listing, harvesters must obtain a permit, report harvests, and follow regulations set by the U.S. Fish and Wildlife Service. (McGraw et al. 2013). In order to yield roots with economic value, ginseng must be grown in forested environments using a wild or wild simulated approach. Because forested ecosystems are required to produce commercially valuable ginseng, forest landowners in Vermont who manage for timber may be interested in ginseng as a secondary forestry crop. Timber harvests introduce anthropogenic disturbance that may negatively affect American Ginseng. Our study is interested in seeing how different silvicultural treatments may affect abundance of established ginseng populations. This study will compare ginseng abundance before and after treatments are applied.

Hypothesis:

Populations of Wild American Ginseng will decrease in abundance as shelterwood harvest intensity increases in Vermont northern hardwoods.

Prediction:

We predict that ginseng abundance will decrease in all stands subject to harvest. Additionally, we intend to see the lowest ginseng abundance following the high intensity harvest.

Figure 1: Jericho Research Forest boundary and treatment locations

Figure 2: Treatment locations and plot distribution. 1/250th acre plot size modeled

Table 1: Site description and Ginseng abundance differences over time

	Residual Overwood	Aspect	Elevation (ft)	Mean Slope	Ginseng (2021) Pre-harvest	Ginseng (2024) Post-harvest
Treatment 1 (Low)	75%	160°	321	25°	23	21
Treatment 2 (Medium)	50%	40°	360	16°	27	22
Treatment 3 (High)	25%	184°	300	10°	25	17
Treatment 4 (Control)	100%	0°	288	13°	28	29

Study Design:

This study will be conducted in the 476-acre Jericho Research Forest, located in Jericho Vermont. Six potential study sites containing wild American ginseng were determined using an existing Ginseng census from a previous research study. This is a manipulated field experiment in which treatments, including a control, will be randomly assigned. The treatments will be conducted in ¼ acre blocks and will vary in harvest intensity. (See figure 1 for treatment location within Jericho Research Forest) Basic site attribute data, such as mean slope, elevation, and aspect should be measured for each treatment block to help account for any confounding factors that occur in field experiments. Residual overwood cover will be measured and binned into three coarse harvest intensity categories: low, medium, and high. (See table 1 for treatment assignment, specific site attributes, and residual overwood percentage.)

Fixed radius plots with an area of 1/250th of an acre will be used to determine ginseng abundance. 10 plots will be randomly selected within each treatment, and plot centers will be visibly marked. (See figure 2) Ginseng abundance will be measured at each plot one year prior to harvest and three years post-harvest.

Each error bar is constructed using a 95% confidence interval of the mean
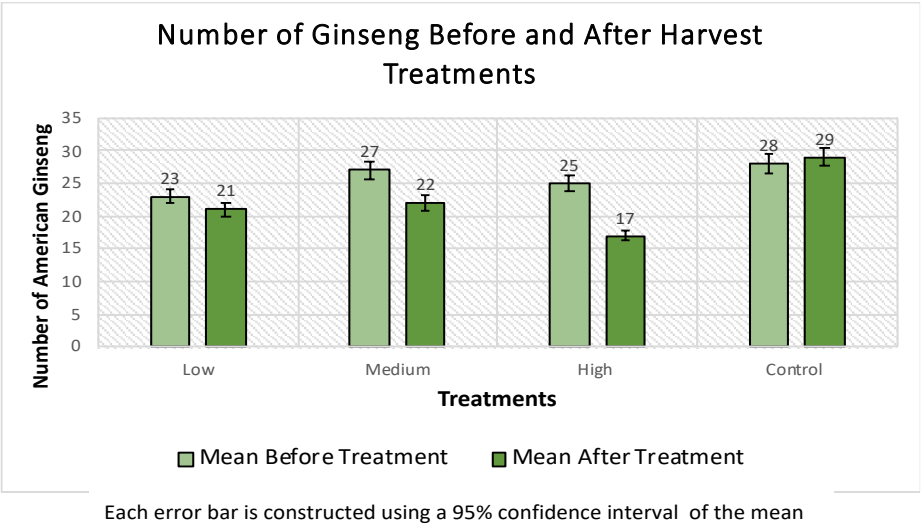
Figure 3: Ginseng abundance before and after harvest treatments

Intended Analysis:

This study will measure the differences in species abundance of American ginseng based on varying shelterwood intensities. The intensity of the harvest is therefore the independent variable in this study and is a categorical data type. Ginseng abundance is the dependent variable and is a continuous data type.

Based on the types of data collected, an ANOVA test should be conducted to determine statistical significance. An ANOVA will be able to check for differences in ginseng abundance before and after treatments were applied. One limitation of this study design is pseudoreplication. Although multiple plots were assigned to each treatment, this replication is not true replication. To create a study that is more representative of the Vermont landscape as a whole, replication of treatments would be necessary.

Literature Cited:

Chamberlain, J., Prisley, S., & McGuffin, M. (2013). Understanding the Relationships between American Ginseng Harvest and Hardwood Forests Inventory and Timber Harvest to Improve Co-Management of the Forests of Eastern United States, *Journal of Sustainable Forestry*, DOI:10.1080/10549811.2013.798828

Chandler, J., & McGraw, J. (2015). Variable effects of timber harvest on the survival, growth, and reproduction of American ginseng (*Panax quinquefolius L.*). *Forest Ecology and Management*, 344, 1-9. https://doi.org/10.1016/j.foreco.2015.02.007

Hannah, P. (1991). Regeneration of Northern Hardwoods in the Northeast with the Shelterwood Method. *Northern Journal of Applied Forestry, 8*, (3), 99-104. https://doi.org/10.1093/njaf/8.3.99

McGraw, J. B., Lubbers, A. E., Van der Voort, M., Mooney, E. H., Furedi, M. A., Souther, S., ... & Chandler, J. (2013). Ecology and conservation of ginseng (Panax quinquefolius) in a changing world. *Annals of the New York Academy of Sciences*, *1286*(1), 62-91.

Vaughan, R. C., Chamberlain, J. L., & Munsell, J. F. (2009). Growing American ginseng (Panax quinquefolius) in forestlands.
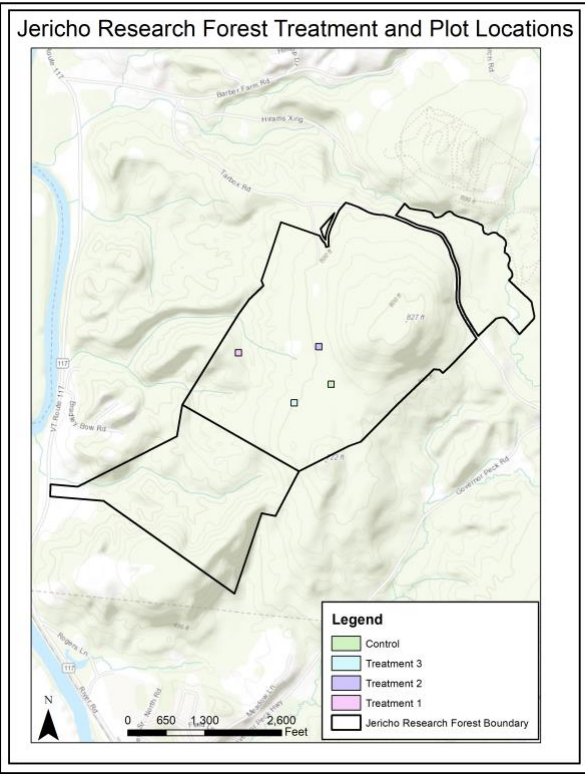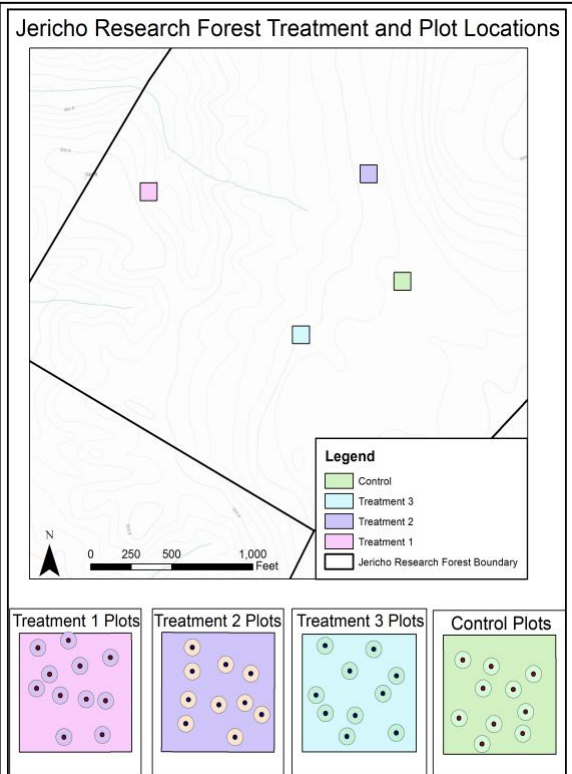
Figure 4: Mature American ginseng plant with berries
Credit: Gary Kauffman/U.S. Forest Service