The National Forest Service is required to consider climate change impacts in plan development: As summarized by Anthony Erba, while USFS Director of the Eastern Region:

- Purpose and Need for the New Rule "…the Department and the Forest Service find that a planning rule must address the following…purposes and needs:
    - Emphasize restoration of natural resources to make our NFS lands more resilient to climate change, protect water resources, and improve forest health.
    - Contribute to ecological, social, and economic sustainability by ensuring that all plans will be responsive and can adapt to issues such as the challenges of climate change; the need for forest restoration and conservation, watershed protection, and species conservation; and the sustainable use of public lands to support vibrant communities…"
- Assessments Section 219.6(b)(3)–(4)
    - Requires responsible officials to identify and evaluate information on climate change and other stressors relevant to the plan area, along with a baseline assessment of carbon stocks, as a part of the assessment phase.
- Sustainability Section 219.8(a)(1)(iv)
    - Requires climate change be taken into account when the responsible official is developing plan components for ecological sustainability. Climate change is viewed as one of many system drivers.
- Multiple Use Section 219.10(a)(8)
    - When providing for ecosystem services and multiple uses, the responsible official is required by to consider climate change. Climate change is viewed as one of many system drivers
- Monitoring Section 219.12(a)(5)(vi)
    - Measurable changes to the plan area related to climate change and other stressors affecting the plan area are to be monitored.

Source: Erba, Anthony. (2012) *Climate Change and the 2012 Planning Rule: Applying science to planning.* United States Forest Service.
https://forestthreats.org/news/ffaccts/climate-change-and-the-2012-planning-rule-1/file

Forests play an active role in the terrestrial carbon stocks and flows. As a result, management techniques to maintain or increase forest carbon has gained significance as a strategy to reduce atmospheric CO2 concentrations (McKinley 2011). Specifically, forests in the United States are an important source for carbon sequestration (McKinley 2011). Harvesting practices contribute to carbon loss in forests more than any other natural disturbance (Harris 2016). In fact, lumber harvesting results in a net loss of forest carbon, due to the decreased sequestering abilities of wood product in comparison to standing forests (Ingerson 2011). In addition, reforestation on land used for harvesting does not restore the carbon potential of the original forest (McKinley 2011). Therefore, avoiding deforestation of U.S. forests for lumber harvesting is the most viable management strategy to maintain, or increase, carbon sequestration. In addition to the carbon storage, avoided deforestation provides economic and environmental co-benefits (McKinley 2011). Thus, we strongly suggest that the Wayne National Forest Plan should take into account the benefits of avoiding deforestation to maximize the carbon potential of the Wayne.

The scientific literature below gives support and additional detail to our comment.

Observation A.

86% of annual forest carbon loss is attributed to harvest alone. This is greater than all other sources of carbon loss, that is, insects, fire, wind, and drought, combined.

Supporting Literature - See: Harris, N. L., Hagen, S. C., Saatchi, S. S., Pearson, T. R. H., Woodall, C. W., Domke, G. M., … Yu, Y. (2016). Attribution of net carbon change by disturbance type across forest lands of the conterminous United States. Carbon Balance and Management, 11(1), 24. https://doi.org/10.1186/s13021-016-0066-5 (Table 4, net C loss (Tg C per year): Timberlands = 162 ± 10; Insect damage = 9 ± 1; Forest fire = 7 ± 1; Wind damage = 5 ± 1; Drought = 5 ± 1)

Observation B.

Harvested wood may be seen as a potential source of carbon sequestration. However, after being harvested, only 1% of the original carbon in wood is actually sequestered in wood products.

Supporting Literature - See: Ingerson, A. (2011). Carbon storage potential of harvested wood: summary and policy implications. Mitigation and Adaptation Strategies for Global Change, 16(3), 307–323. https://doi.org/10.1007/s11027-010-9267-5 ("The carbon stored long-term in harvested wood products may be a small proportion of that originally stored in the standing trees—across the United States approximately 1% may remain in products in- use and 13% in landfills at 100 years post-harvest."; "Not all wood products help build long-lived carbon stores, and high processing and transport emissions may undermine any gains achieved.")

Observation C.

Net carbon sequestration from lumber harvesting is further reduced because of the fossil fuel inputs associated with growing and harvesting the wood.

Supporting Literature - See: Ingerson, A. (2011). Carbon storage potential of harvested wood: summary and policy implications. Mitigation and Adaptation Strategies for Global Change, 16(3), 307–323. https://doi.org/10.1007/s11027-010-9267-5 ["growing the harvested wood pool relies on continued fossil fuel inputs and requires space for housing and landfills that displace carbon-fixing vegetation."]

Observation D.

Deforestation decreases the carbon stored in forests. Reforestation after lumber harvesting does not fully compensate for the carbon loss resulting from the deforestation.

Supporting literature - See McKinley, D. C., Ryan, M. G., Birdsey, R. A., Giardina, C. P., Harmon, M. E., Heath, L. S., … Skog, K. E. (2011). *A synthesis of current knowledge on forests and carbon storage in the United States*. *Ecological Applications*(Vol. 21). Retrieved from https://www.fs.fed.us/rm/pubs_other/rmrs_2011_mckinley_d001.pdf At 1910, ["Currently, global deforestation results in the gross annual loss of nearly 90 000 km2, or 0.2% of all forests (FAO 2007, IPCC 2007), which is estimated to release 1400–2000 Tg C/yr"] and ["Forests in the United States provide a strong carbon sink."] At 1918, ["Forest loss moves carbon from forests to the atmosphere, particularly where the loss includes not only trees but also the decomposition of soil carbon."] At 1911, ["Generally, harvesting forests with high biomass and planting a new forest will reduce overall carbon stocks more than if the forest were retained, even counting the carbon storage in harvested wood products (Harmon et al. 1996, Harmon et al. 2009)."] and ["Some old growth forests in Oregon, for example, store as much as 1100 Mg C/ha (Smithwick et al. 2002), which would take centuries to recoup if these stocks were liquidated and replaced, even with fast growing trees."]

See Harris, N. L., Hagen, S. C., Saatchi, S. S., Pearson, T. R. H., Woodall, C. W., Domke, G. M., … Yu, Y. (2016). Attribution of net carbon change by disturbance type across forest lands of the conterminous United States. Carbon Balance and Management, 11(1), 24. https://doi.org/10.1186/s13021-016-0066-5 ["deforestation, averaging 0.1 million ha per year, resulted in C losses of 6 ± 1 Tg C year−1."]

Observation E.

Forest management plays a key role in the carbon dynamic of U.S. forests, and can be beneficial, as long as the management techniques take into account for the possible long-term environmental and economic benefits and tradeoffs.

Supporting literature: See McKinley, D. C., Ryan, M. G., Birdsey, R. A., Giardina, C. P., Harmon, M. E., Heath, L. S., … Skog, K. E. (2011). *A synthesis of current knowledge on forests and carbon storage in the United States*. *Ecological Applications*(Vol. 21). Retrieved from https://www.fs.fed.us/rm/pubs_other/rmrs_2011_mckinley_d001.pdf At 1903, ["forests and products from forests could be managed to sequester more carbon and slow the release of carbon to the atmosphere"] At 1911, ["Forest management can increase the interval between harvests or decrease harvest intensity and thereby increase forest carbon stocks (Schroeder 1992, Thornley and Cannell 2000, Liski et al. 2001, Harmon and Marks 2002, Jiang et al. 2002, Seely et al. 2002, Kaipainen et al. 2004, Balboa-Murias et al. 2006, Harmon et al. 2009)."] At 1917, ["Each forest carbon storage strategy should be evaluated in terms of its effect on storage and emissions within and outside of the forest, the cost of implementation, the timing of net carbon benefit (Marland et al. 1997), the capacity to offset CO2 emissions, and the risks and uncertainties."]

See Harris, N. L., Hagen, S. C., Saatchi, S. S., Pearson, T. R. H., Woodall, C. W., Domke, G. M., … Yu, Y. (2016). Attribution of net carbon change by disturbance type across forest lands of the conterminous United States. Carbon Balance and Management, 11(1), 24. https://doi.org/10.1186/s13021-016-0066-5 ["Given that wood harvest represents the majority of C losses from US forests, increasing the US net forest C sink would require shifts in current forest management practices"]

Observation F.

Avoiding deforestation as a strategy to increase carbon has the lowest risk and greatest co-benefits.

Supporting literature: See McKinley, D. C., Ryan, M. G., Birdsey, R. A., Giardina, C. P., Harmon, M. E., Heath, L. S., … Skog, K. E. (2011). *A synthesis of current knowledge on forests and carbon storage in*

the United States. *Ecological Applications*(Vol. 21). Retrieved from https://www.fs.fed.us/rm/pubs_other/rmrs_2011_mckinley_d001.pdf At 1915, [“Avoided deforestation protects existing forest carbon stocks with low risk and many co-benefits.”] At 1916, See Table 2. “Uncertainty, co-benefits, and trade-offs of proposed carbon mitigation strategies”, Co-benefits, [“Watershed protection, biodiversity, wildlife habitat, recreation opportunities depend on type of avoided deforestation”] At 1918, [“Avoiding loss of forests should be a strong policy consideration owing to very low risk and little uncertainty.”]