FIRST EVER USA MATURE & OLD-GROWTH FORESTS MAPPING ASSESSMENT: A RESPONSE TO PRESIDENT BIDEN'S EXECUTIVE ORDERS ON FORESTS AND 30 X 30

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WILD HERITAGE

Griffith UNIVERSITY
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NATURESERVE

Woodwell Climate Research Center

one earth

TWO EX ORDERS, A MEMO, & BLM RULEMAKING

"Forests are the Lungs of the Planet," President Biden Earth Day 2022

EO 14008 – Tackling Climate Crisis at Home and Abroad – "…..achieve the goal of conserving at least 30 percent of our lands and waters by 2030"

EO 14072 – "within 1 year of the date of this order, define, identify, and complete an inventory of old-growth and mature forests on Federal lands, accounting for regional and ecological variations, as appropriate, and shall make such inventory publicly available."

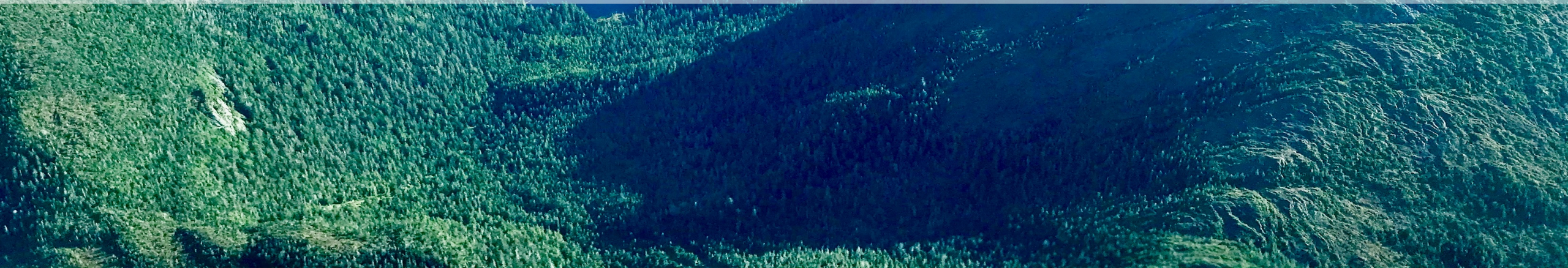
"develop policies, with robust opportunity for public comment, to institutionalize climate-smart management and conservation strategies that address threats to mature and old-growth forests on Federal lands."

Sec Vilsack Memo – "Take bold action to restore forests, improve resilience, and curb climate change"

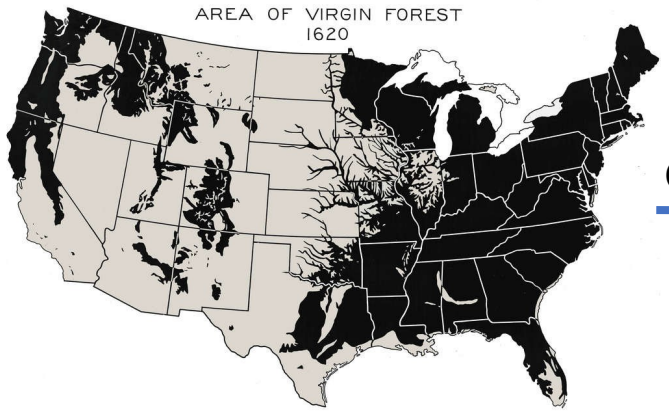
BLM – Conservation & Landscape Health Rulemaking underway

NATURE'S BEST CLIMATE SOLUTIONS

- Ecosystems can provide >1/3 mitigation benefit for keeping climate from overheating >1.5° C (Griscom et al. 2017)
- Most of that can come from protection of primary forests (Keith et al. 2009, Mackey et al. 2014) and proforestation (Moomaw et al. 2019, DellaSala et al. 2020)
- Reduced Impact Logging, Climate Smart Forestry, Light Touch Logging, Sustainable Logging at best are delayed emissions (Zimmerman and Kormos 2012, Law et al. 2018, Hudiburg et al 2019)

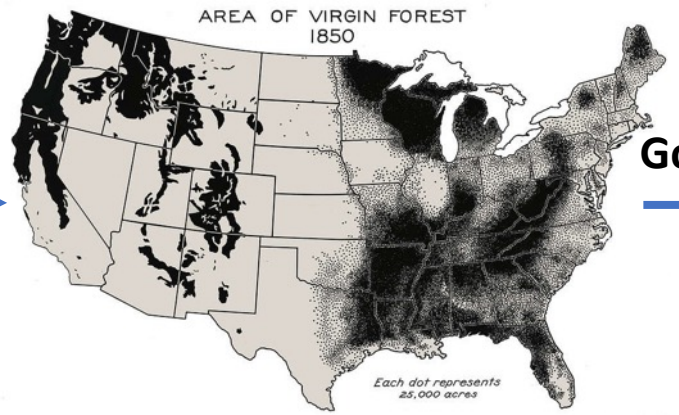


MOST PRIMARY FORESTS GONE IN CONTERMINOUS USA BUT FORESTS ARE MATURING IN PLACES (PROFORESTATION OPPORTUNITY)



At the time of European settlement in North America, primary (or virgin) forests covered nearly all of the East Coast.

Going



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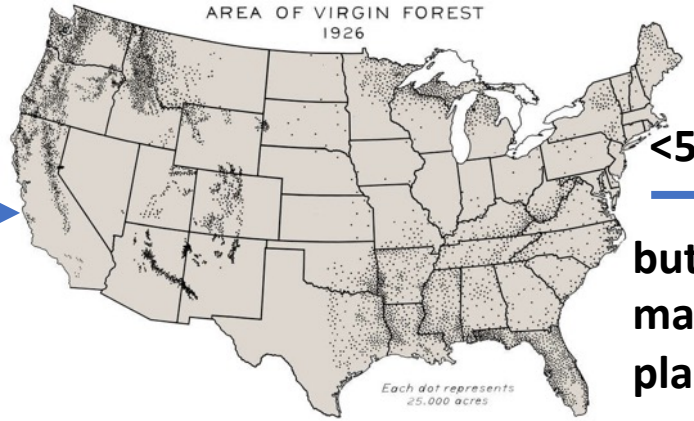

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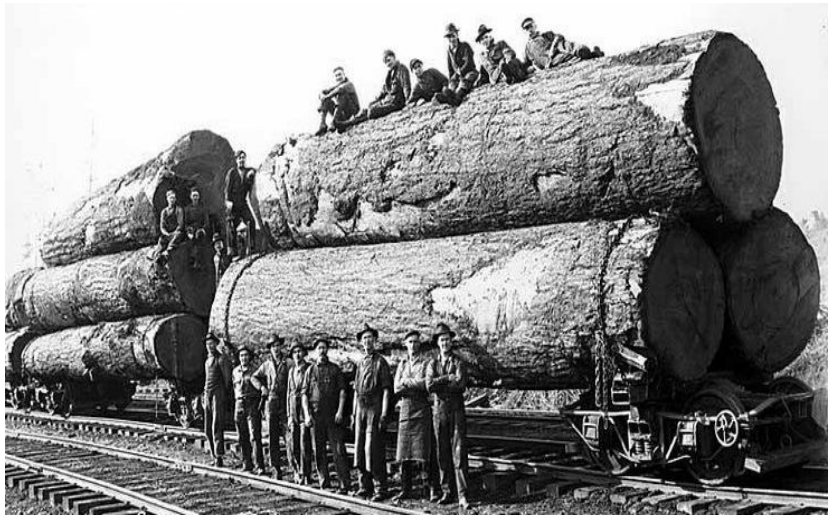
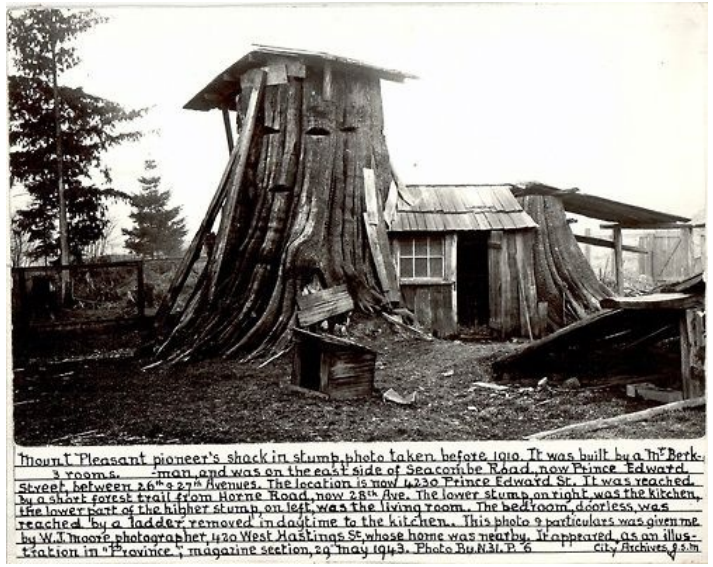
but forests maturing in places





Source: www.slideshare.net/WorldResources/virgin-forests-southern based on Greeley 1925

WHEN DOES A TREE/FOREST BECOME A SENIOR MEMBER OF THE COMMUNITY? (Social Security for Forests?)

- **Old growth - “ancient,” “cathedral,” “antique,” “primary” – Regional Forest Service definitions (1989) need updating and are not spatially explicit (100-150 + yrs)**

- **Mature - complex structures, processes, functions (what is the reference?)**

- **Silvicultural maturation - trees slow growth as they age (CMAI or Culmination Net Primary Productivity) – 35-75 years (Birdsey et al. 2023)**

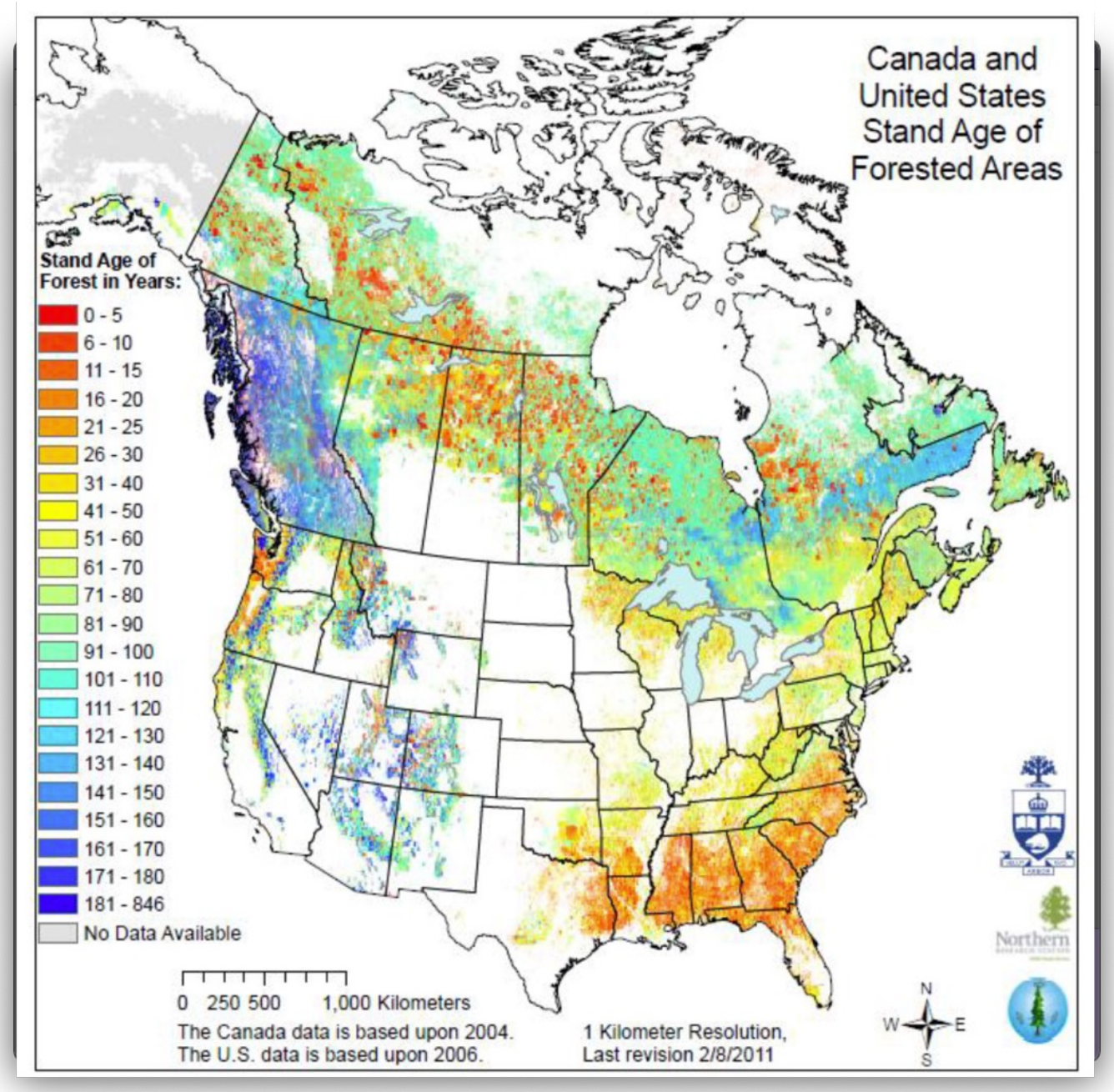
Ecological maturation

- **Mature structure – large trees, vertical/horizontal layering, snags/logs, canopy branching present at some level (around $\pm$ 80 yrs) (DellaSala et al. 2023)**

- **Mature processes – gap phase dynamics, predator-prey food webs, pollination, nutrient cycling, soils with well-developed mycorrhizal connections – underground forest highway**

- **Mature functions - climate buffering, water regulation, fire refugia, carbon stores, ecosystem services advanced (multiple citations available on request)**

PRIOR MAPPING – CONTINENTAL SCALE

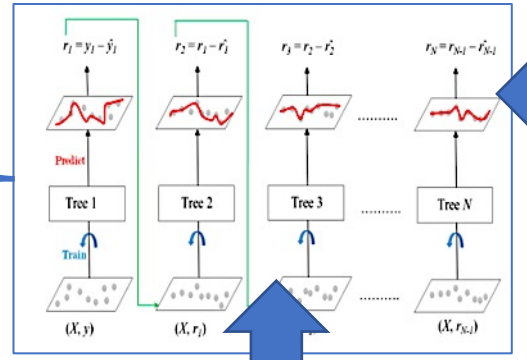


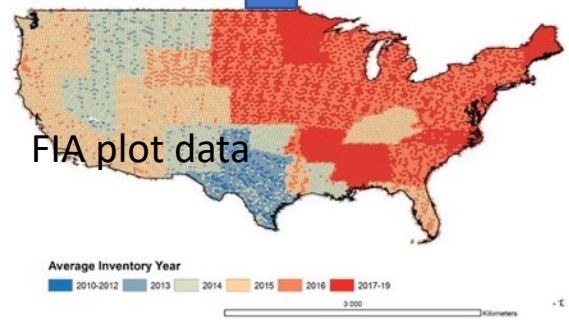
Source: Pan et al. 2011

- Dated 2006 forest inventory plots (FIA) at 1-km resolution (10 million sq feet, 3162 ft on a side)
- One plot every 6,000 acres is too coarse
- Target setting options: 30 x 30 (Dinerstein et al. 2017), 50% (Noss et al. 2012), 100% MOG protected (DellaSala et al. 2022a)

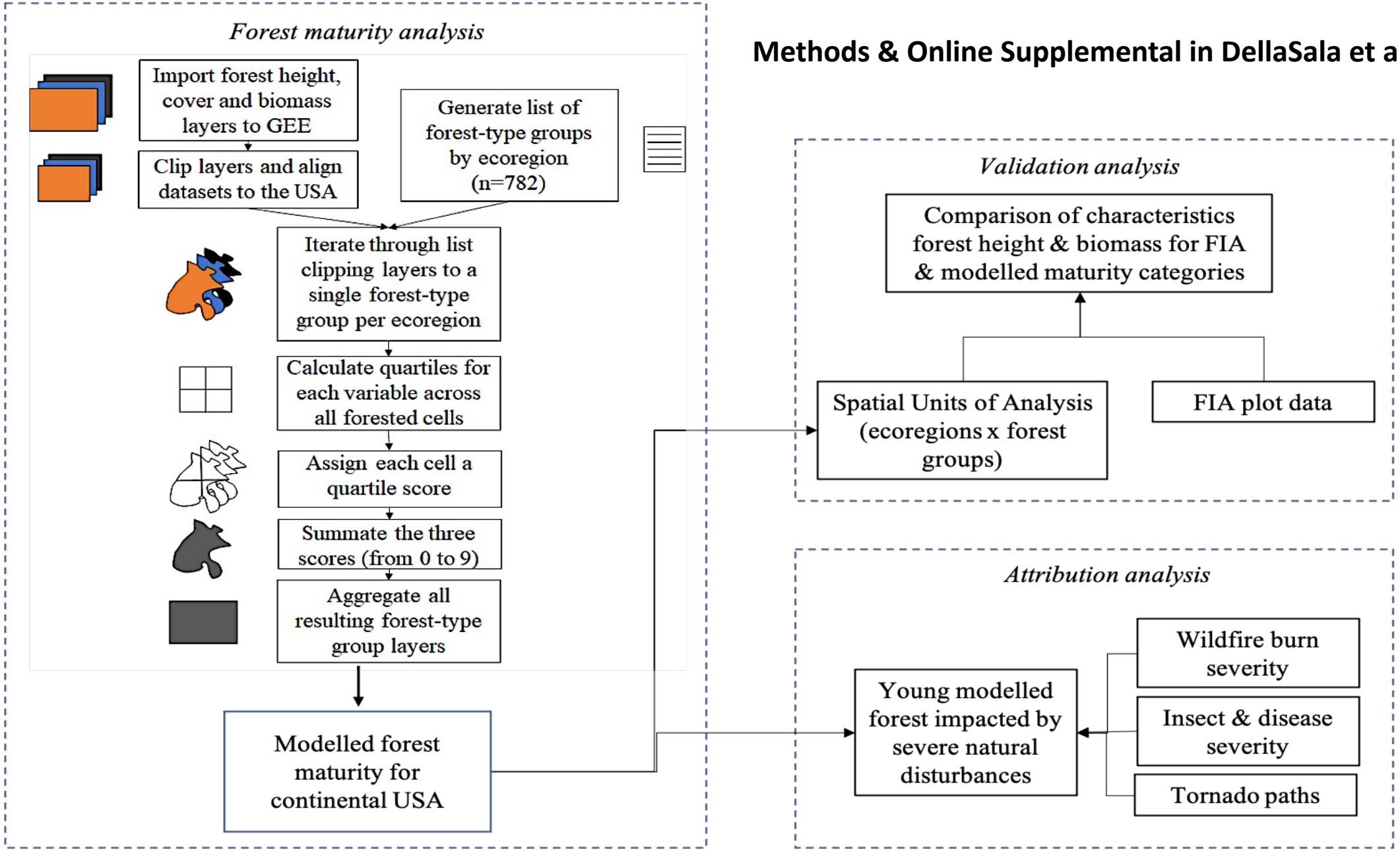
FIRST OF IT'S KIND MATURE/OLD GROWTH (MOG) ANALYSIS

- Spatial models (30-m pixel = 100 ft on a side vs. 3162 ft on a side in 2006 FIA analysis by Pan et al)
- Satellite data (LiDAR, laser pulses = 3D images)
- FIA plot data for calibration of mapped polygons
- Scores for canopy cover + tree height + biomass = continuous structural gradient (young to oldest)

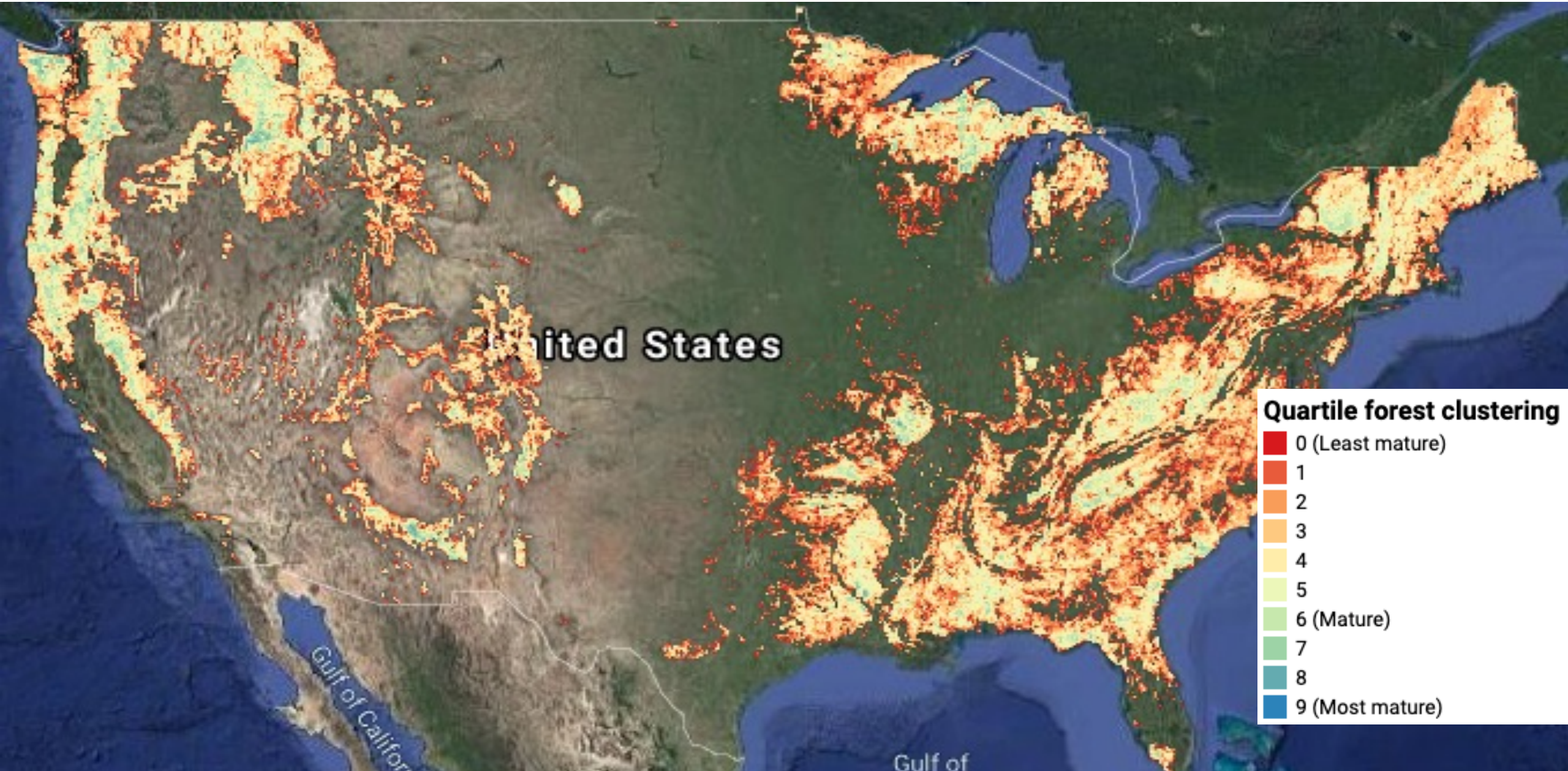




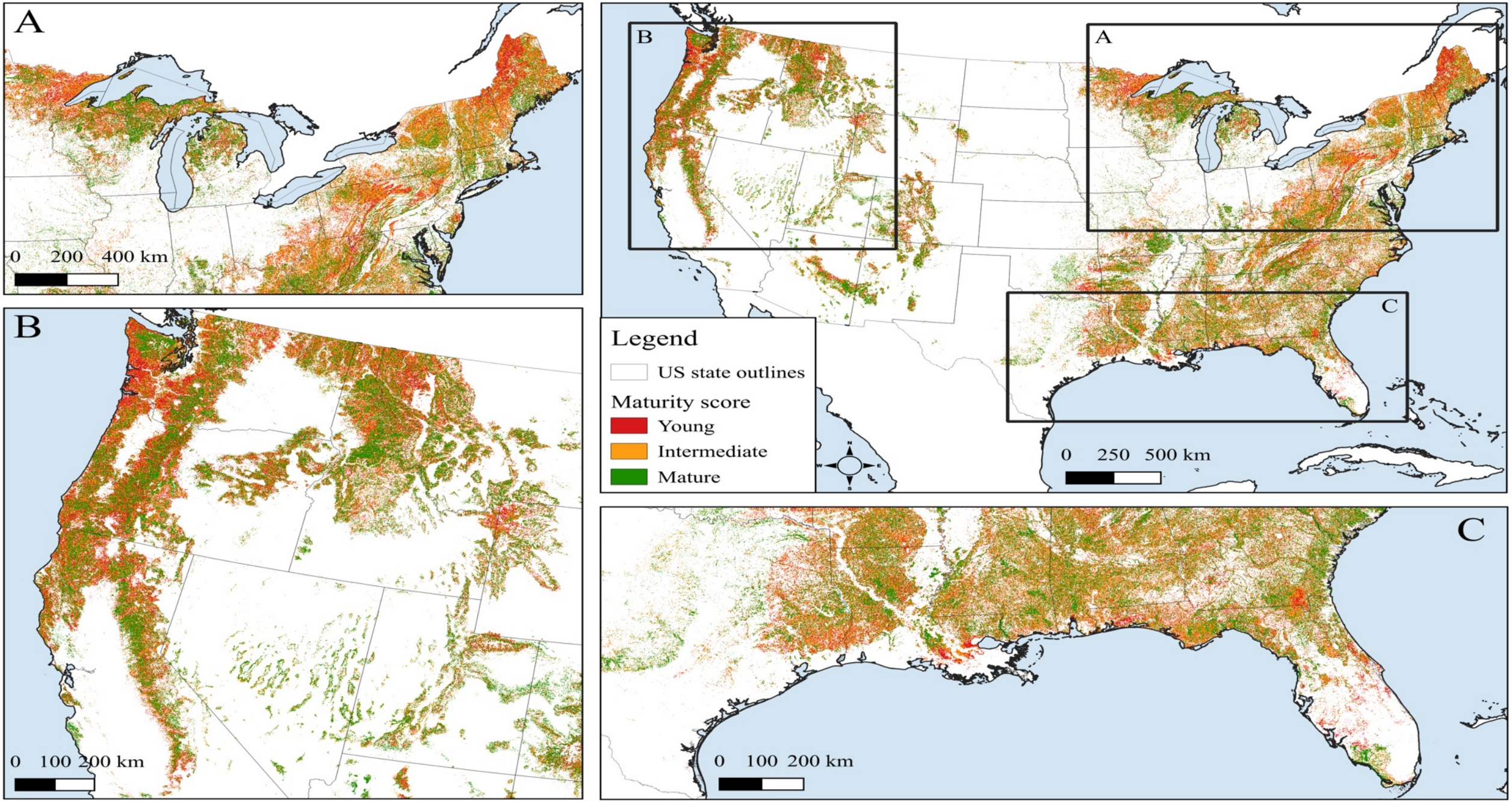
Methods & Online Supplemental in DellaSala et al (2022a)



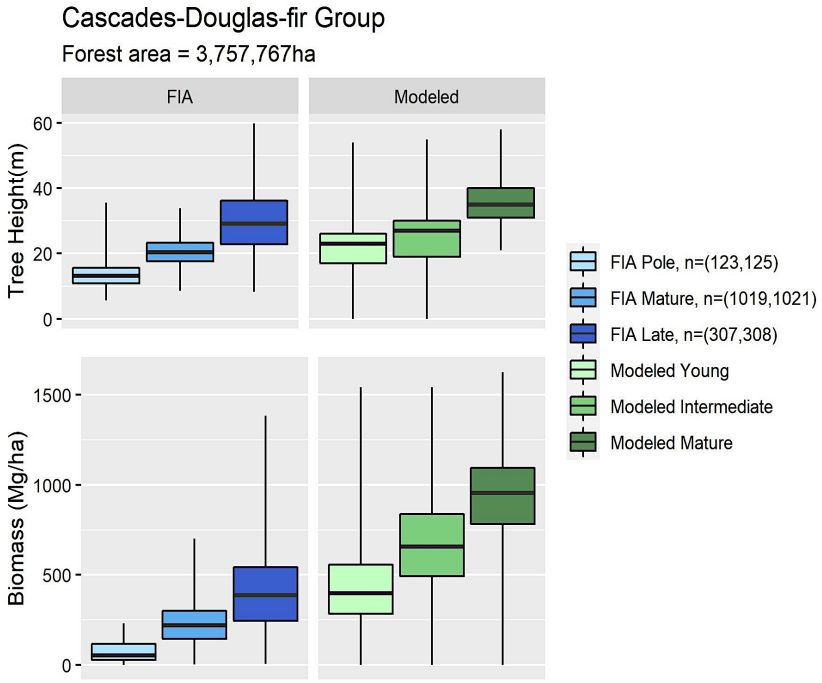
FOREST STRUCTURAL DEVELOPMENT CONTINUITY MAP (LEAST TO MOST ADVANCED)
TREE HEIGHT + CANOPY COVER + BIOMASS

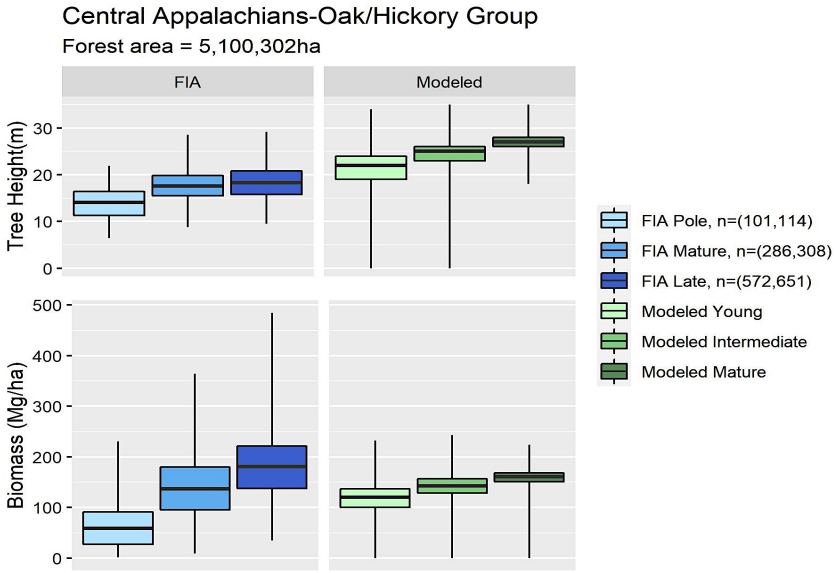


STRUCTURE CLASSES BY REGION (young, intermediate, mature) (DellaSala et al. 2022a)



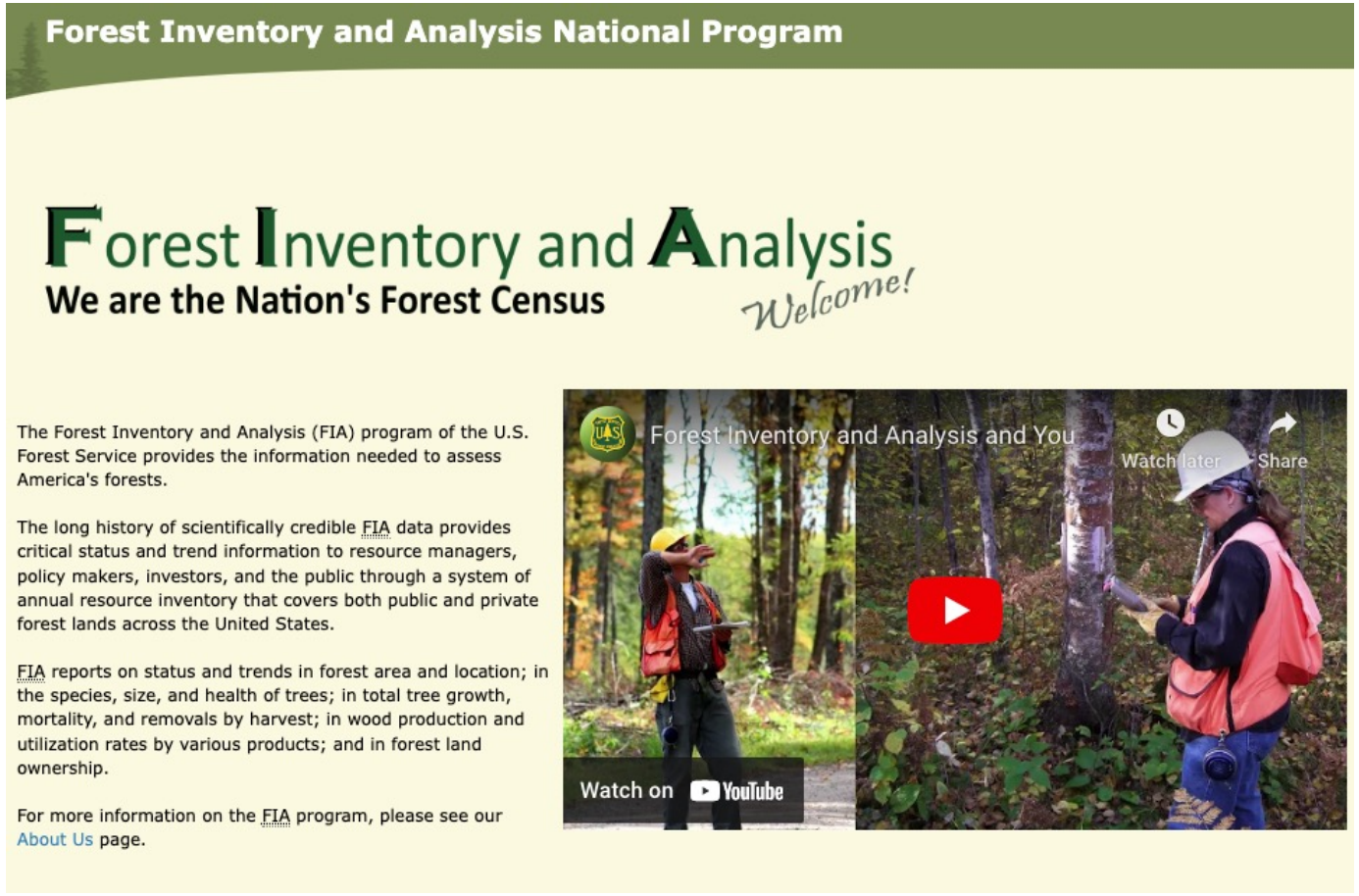
FOREST STRUCTURE MODEL CALIBRATION USING FIA PLOTS



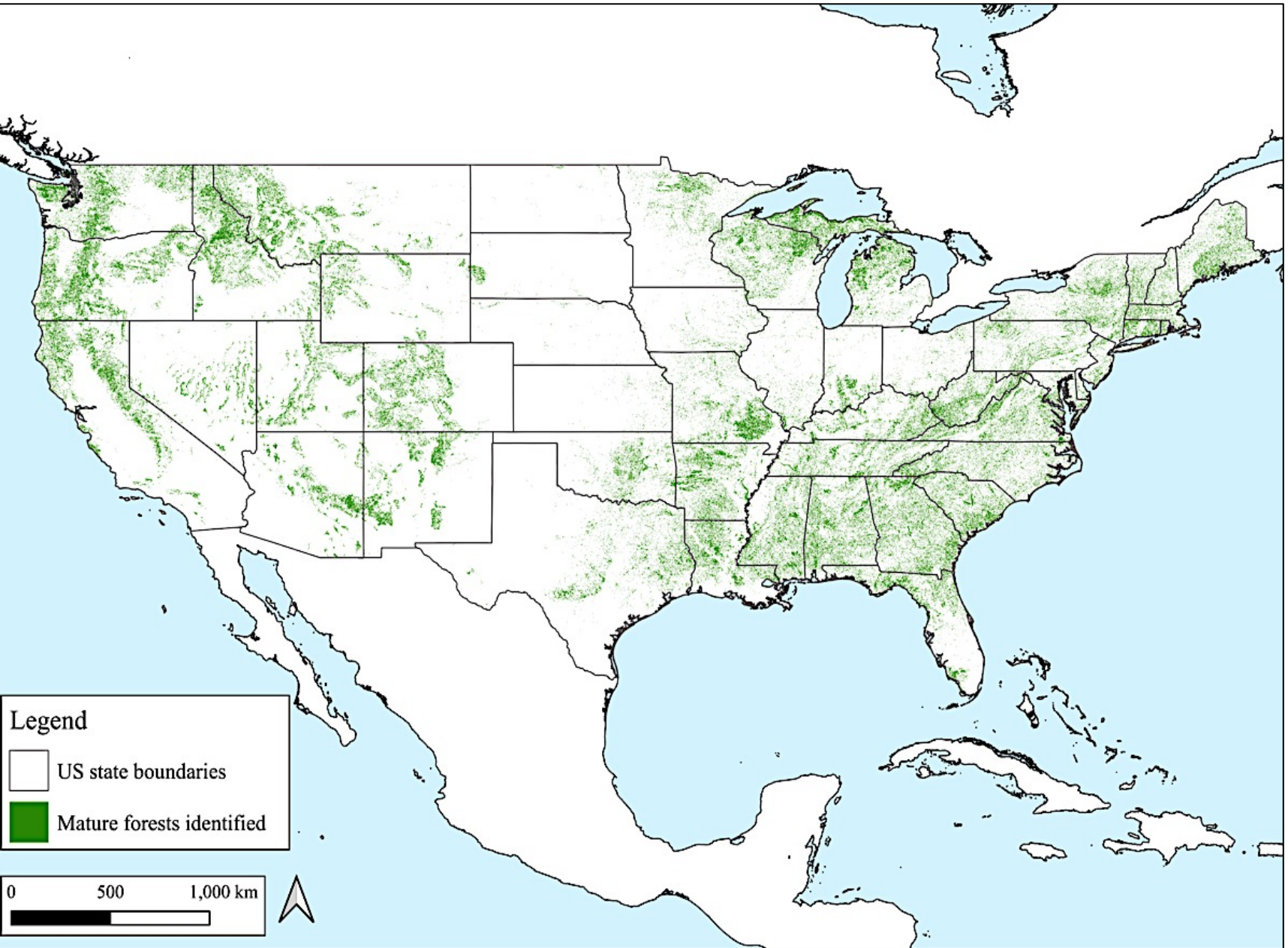


- **Model structure classes (young, intermediate, mature) line up well with FIA (pole, mature, late) for 41 Forest Type Groups**

- **Notable exceptions – transition zones, high elevation forests**



FIRST COMPREHENSIVE COAST TO COAST MOG MAP
(MOG = highest rankings for 3 summed proxies)



"Article 5 (1) Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1(d), of the Convention, including forests."

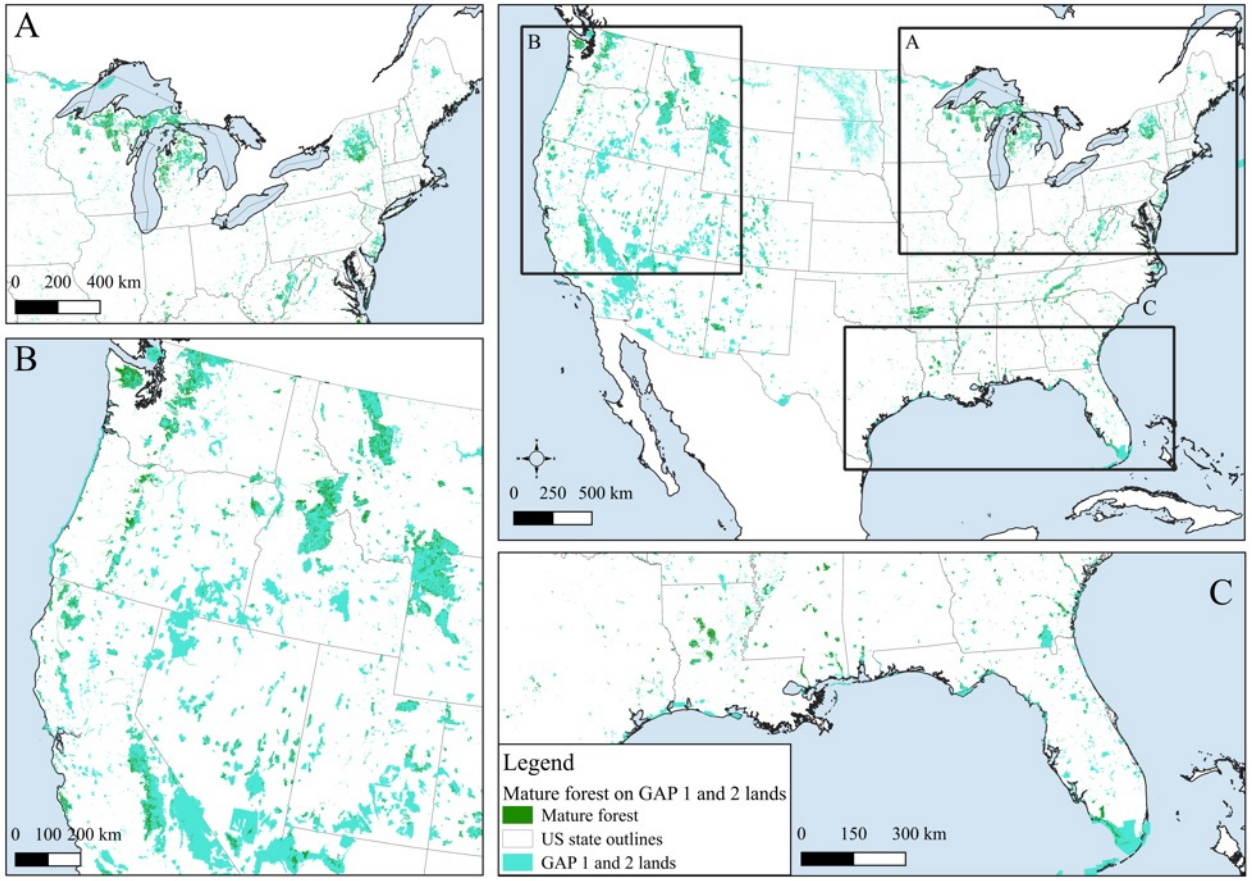
- **Protecting carbon reservoirs (stores/stocks) is vital – not just sinks (Mackey et al. 2013)**
- **National Determined Contributions to Paris Climate Agreement – protect reservoirs and reduce emissions across all sectors, including forestry**

MOG ASSESSMENT OVERLAYS (DellaSala et al. 2022a)

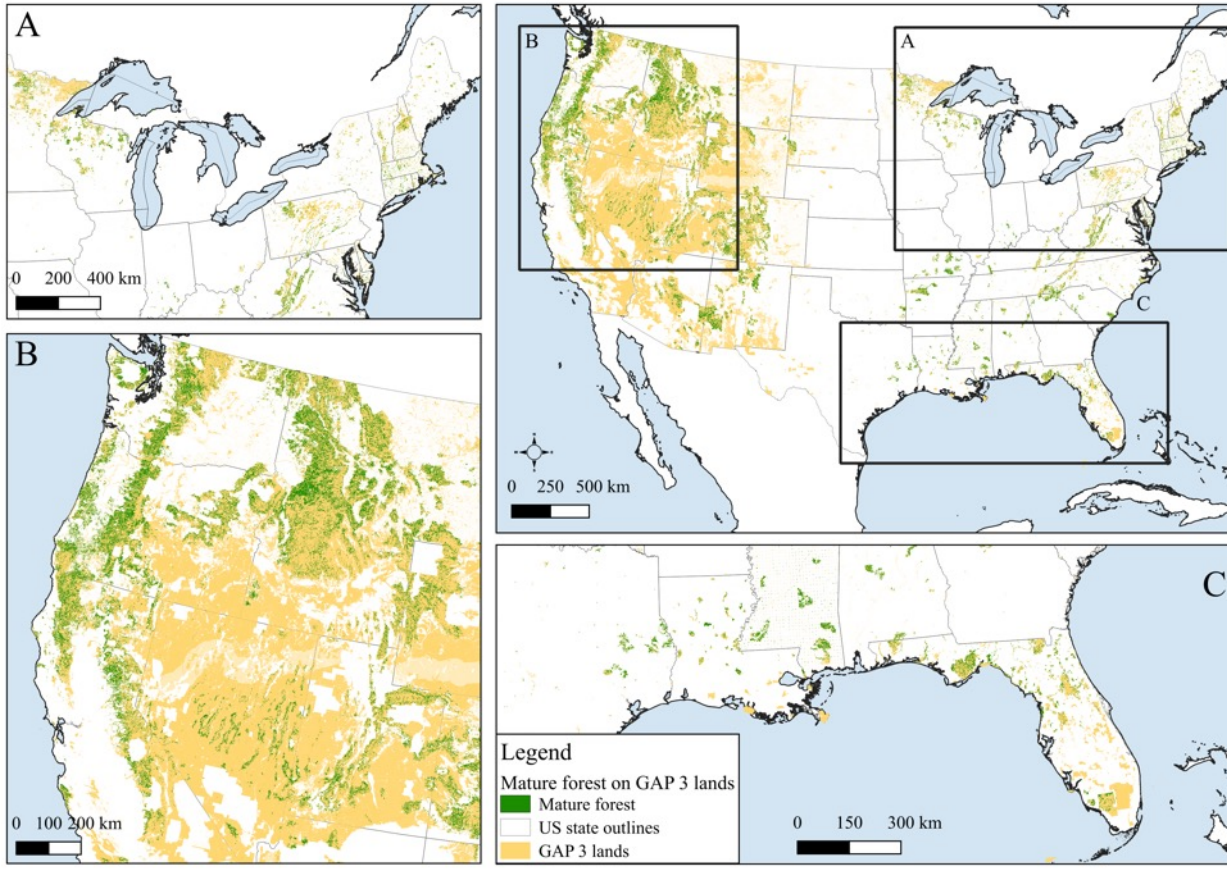
- Spatially explicit (30-m) MOG for every ecoregion, forest type, state, and landowner by GAP status codes (1-4)
- GAP1 = wilderness/parks; GAP2 = national monuments; GAP3 = multiple use; GAP4 –converted to other uses
- GAP 2.5 = inventoried roadless areas (new classification bumped from GAP3)
- Ecosystem services (USFS drinking water, biomass carbon) and imperiled species/ecosystems (NatureServe)
- Look up tables for MOG attributes for every area, landowners, GAP status, etc (matureforests.org – GIS files)

MOG OVERLAID BY REGION AND GAP STATUS

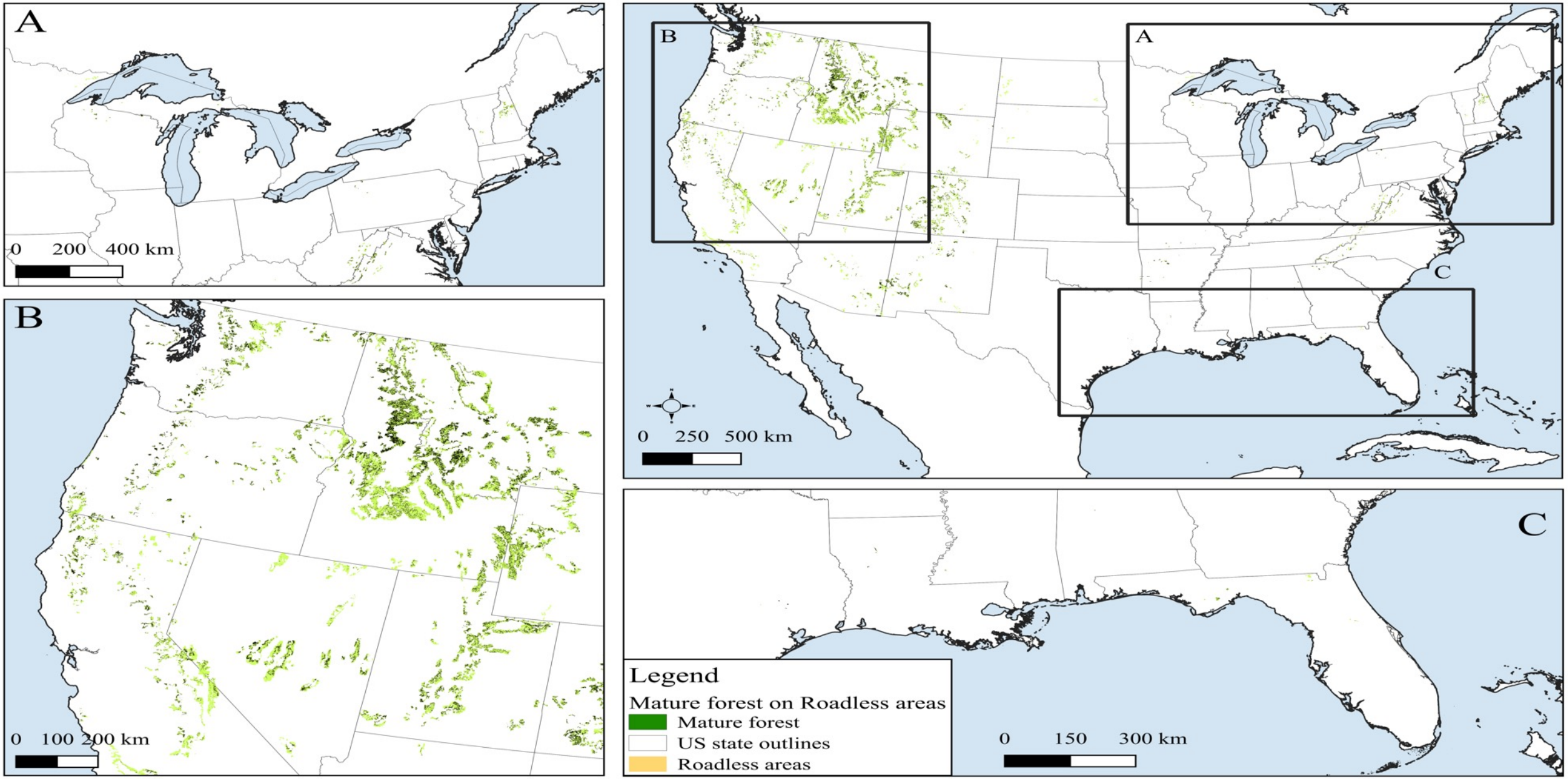
Protected (GAP 1, 2)



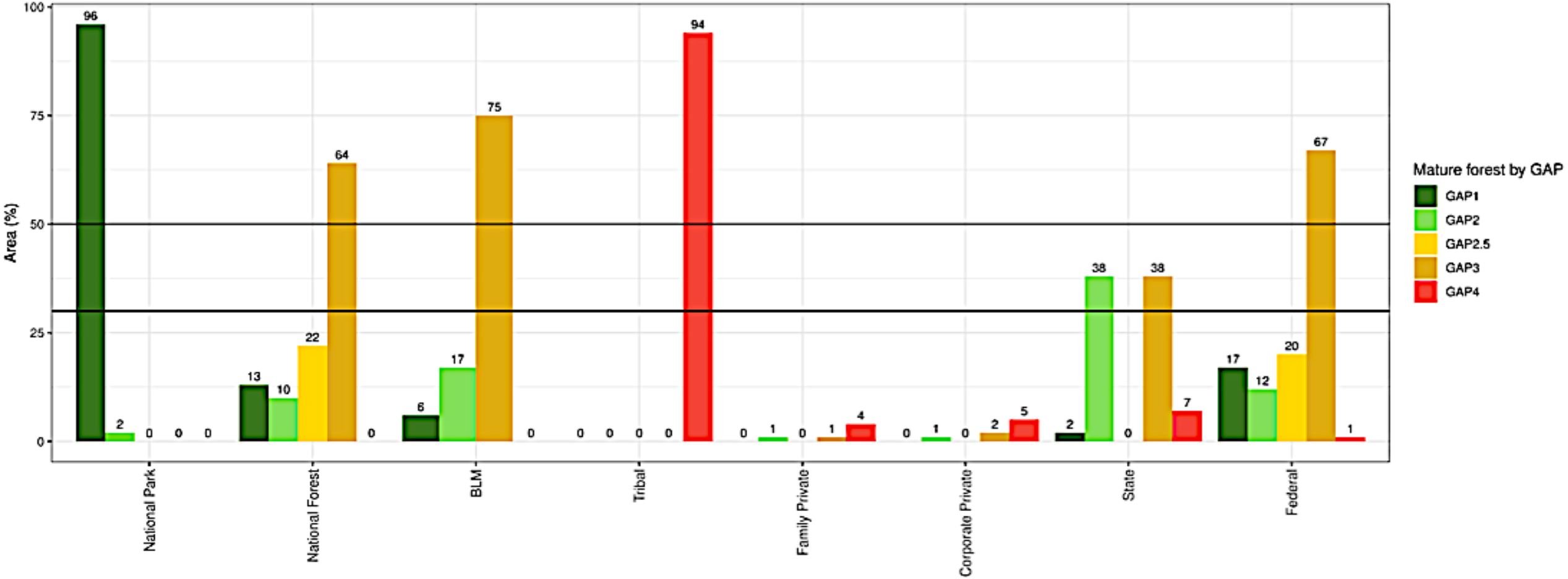
Unprotected (GAP3)



MOG IN ROADLESS AREAS (GAP2.5 instead of GAP3)

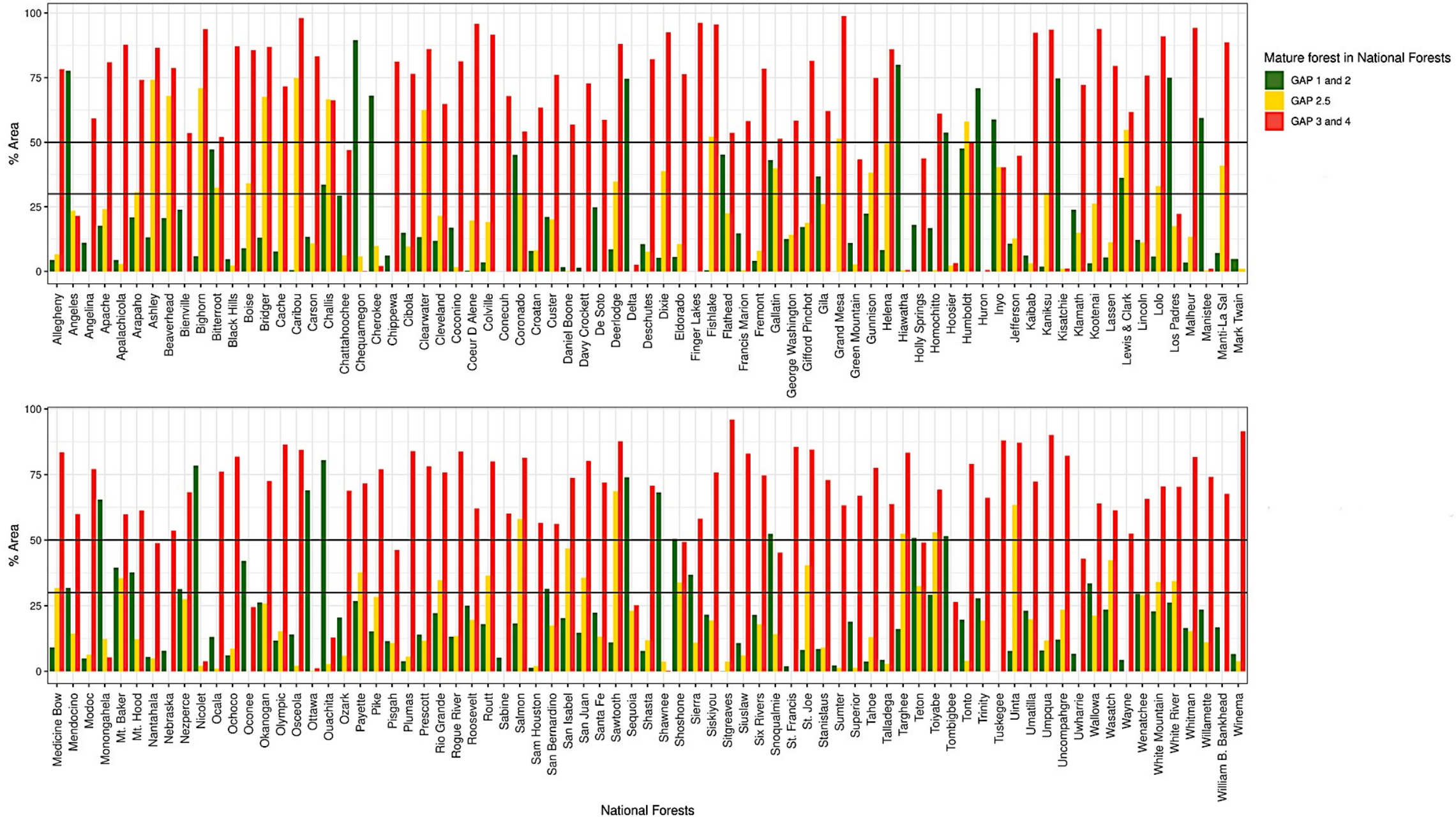


MOG BY LANDOWNER AND GAP STATUS VS 30%, 50%, 100% PROTECTION TARGETS

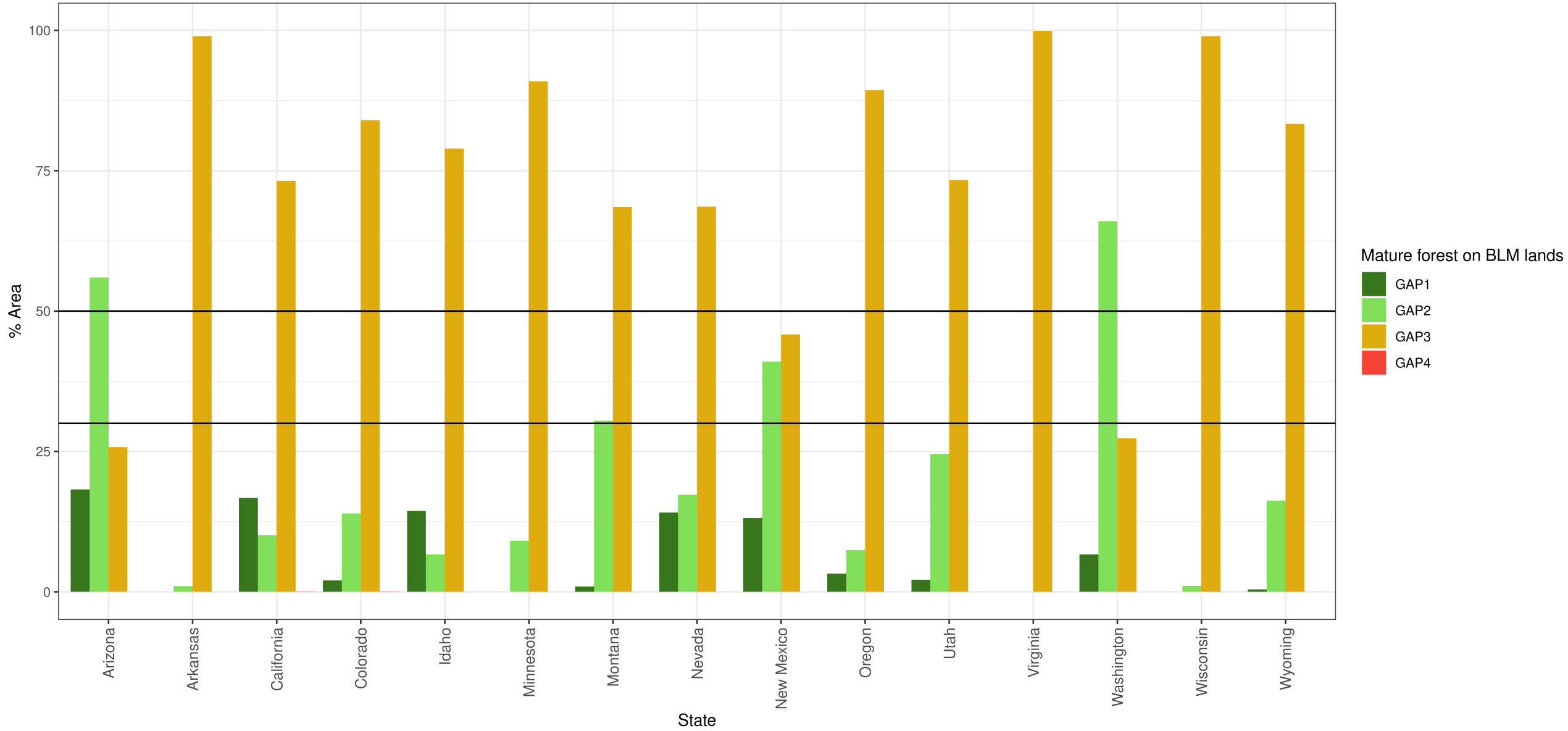


- National Forests MOG = 23% GAP1/2; 22% GAP 2.5; 64% GAP3 (IRA improvements = 45%)
- BLM MOG = 23% GAP1/2; 75% GAP3 (no IRA policy)
- All other landowners except State lands had low levels
- State MOG = 40% GAP1/2; 45% GAP3/4 (significant but not much area)

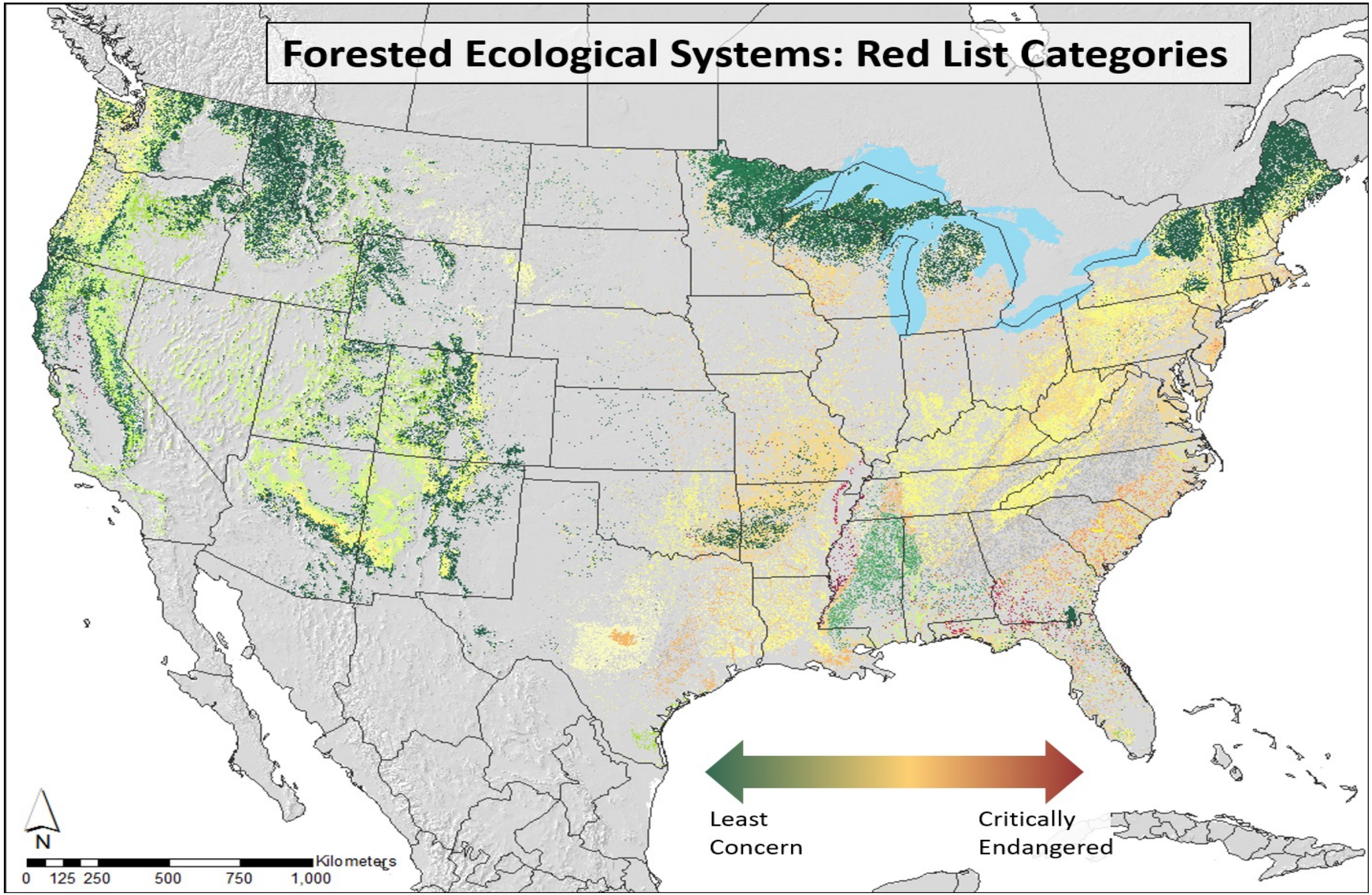
MOB BY NATIONAL FORESTS AND GAP STATUS SHOWING PROTECTION TARGETS
(Only 23% National Forest MOG in GAP 1/2 (greens) (IRA opportunities)



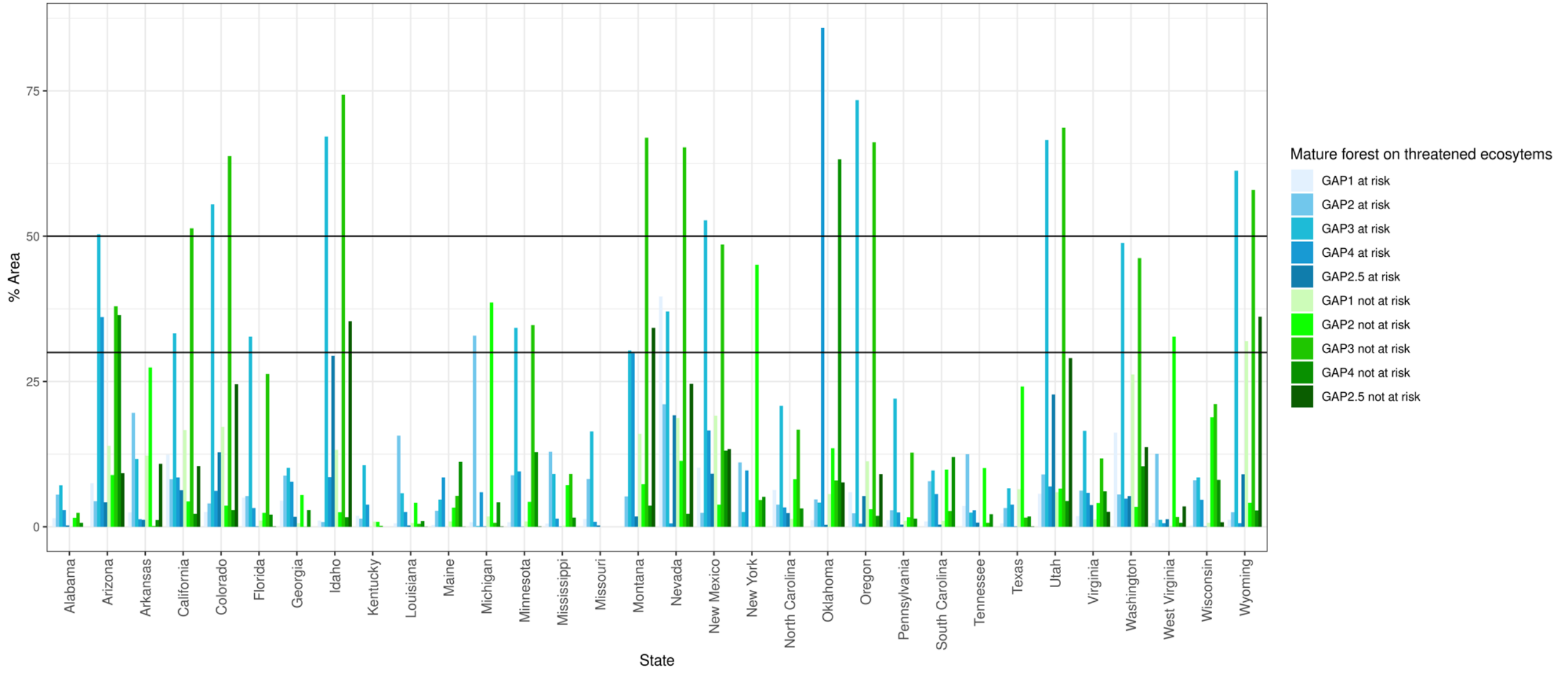
ONLY 23% BLM MOG IN GAP1/2 (greens) (no IRAs)



AT-RISK SPECIES, AT-RISK ECOSYSTEMS, ABOVE GROUND BIOMASS, DRINKING WATER MOG ANALYSIS

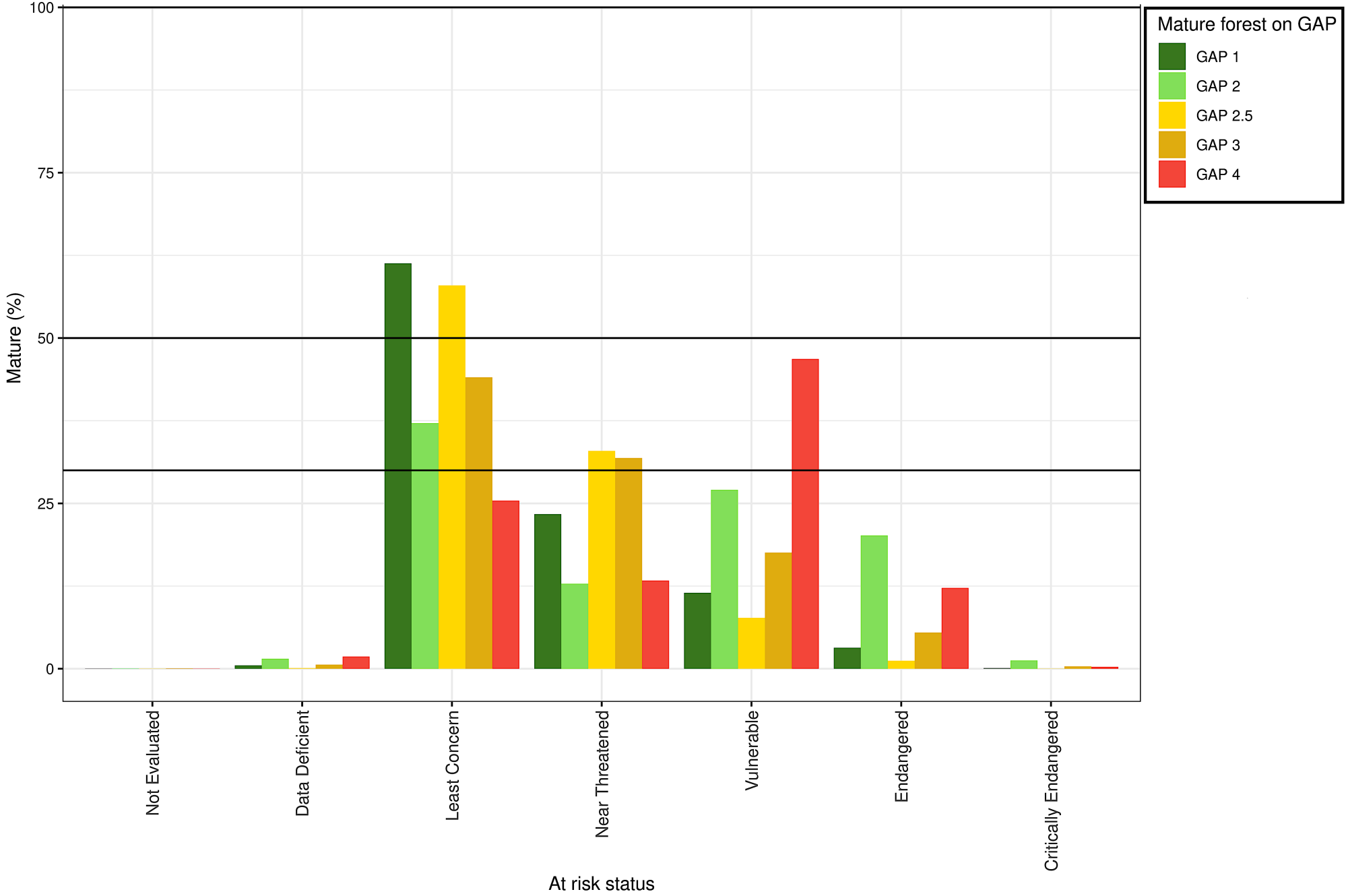

Forested Ecological Systems: Red List Categories
Least Concern
Critically Endangered
N
Kilometers
0 125 250 500 750 1,000

AT-RISK ECOSYSTEMS WITHIN MOG SHOWING PROTECTION TARGETS (NatureServe)

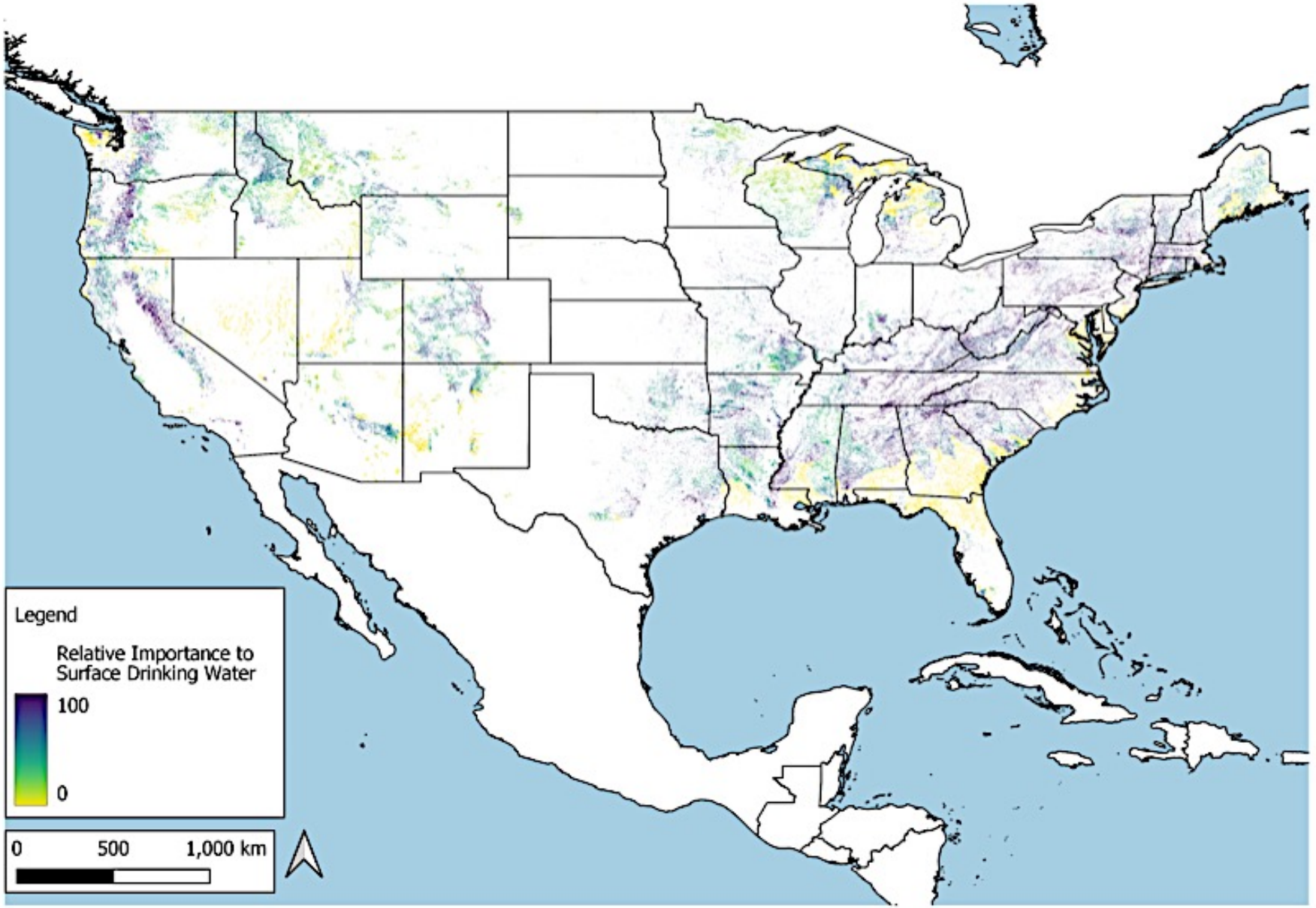


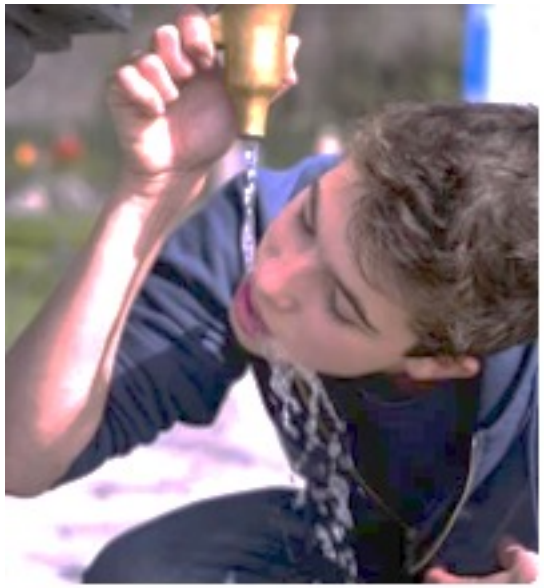
- **>100 Red-listed ecosystems in MOG within and outside protected areas (DellaSala et al. 2022a)**

AT RISK SPECIES AND MATURE FORESTS (NatureServe)



DRINKING WATER SOURCE AREAS IN MOG (USFS NATIONAL FORESTS TO FORESTS LAYERS)



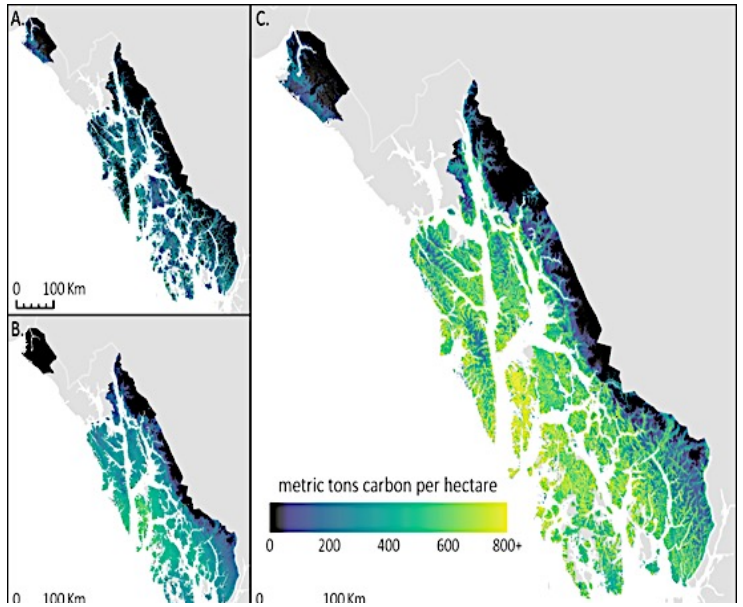


High overlap of MOG with Source Areas and Headwater Reaches

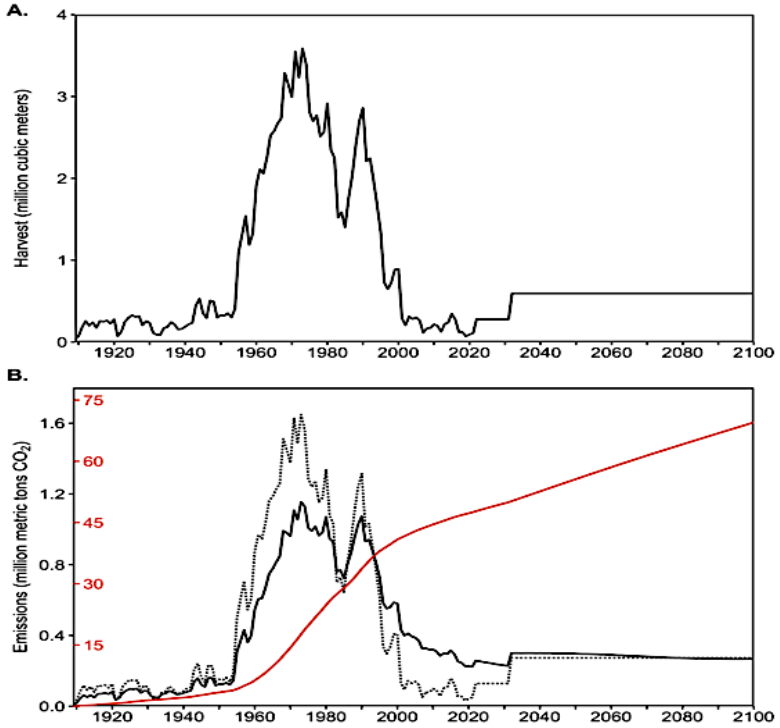
CONCLUSIONS IN THE CONTEXT OF THE EXECUTIVE ORDERS FOR THE CONTINUGOUS USA MOG

- Only 23% MOG protected on both national forests and BLM - not meeting even the lowest bound targets
- IRAs (GAP2.5) with additional protections would bump up national forests to 45% in GAP1/2
- MOG capture substantial carbon, clean water, endangered ecosystems
- MOG cannot do it alone – connectivity, other ecotypes, reduce land stressors, 30% is a floor (not a ceiling)
- Protect all MOG on federal lands (rulemaking) - Article 5.1 Climate Agreement (sinks), Forest Pledges, COP27
- Canada is up next, building on our work in Russia, Europe, tropical countries (Griffith, Woodwell)
- Emissions scenarios analysis underway using Birdsey et al. 2023 and DellaSala et al. (2022a) – 10% projected if MOG logged

TONGASS NATIONAL FOREST ZOOM-IN (DellaSala et al. 2022b)



- 89% old growth remains, only 3% largest trees (globally significant)
- 16% nation's IRAs on just 9% national forest land base ('crown jewel')
- Potential climate refugia (DellaSala et al. 2015, Vynne et al. 2021)
- ~20% of all national forest carbon stock (nationally significant)
- 96% total ecosystem carbon in MOG and IRAs; only 4% in logged
- >100 yrs logging cumulative emissions equivalent >15 million vehicles
- Protect all MOG as industry shifts into young growth (national model)
- Forestry transitions are globally rare with this much primary forest; most happen when nearly all primary is logged!



EO 14072: Manage forests on Federal lands (including MOG) to promote continued health and resilience; retain and enhance carbon storage; conserve biodiversity; mitigate the risk of wildfires; enhance climate resilience." (conflicting goals?)

- MOG is fire refugia - burn in lower intensities (Lesmeister et al. 2021)
- Uncharacteristic fires mostly in industrially landscapes co-triggered by extreme fire weather (Bradley et al. 2016, Zald and Dunn 2018)
- The Northwest Forest Plan designated redundant MOG reserves allowing natural processes-recruitment > loss (DellaSala et al. 2015, Davis et al. 2021)
- When old forests burn they are already resilient–climate change a concern if size of high severity patches increase–so far not so (DellaSala&Hanson 2019)
- Treatment priority should be industrial landscapes where most fires spill over (Downing et al. 2021) and small trees (Zald and Dunn 2018)
- Carbon storage in MOG is far superior than any managed forest – most carbon is emitted when forests are logged, thinned, etc
- Strategically target heavily logged areas and areas closest to homes
- Any presumed benefit of MOG thinning comes with substantial ecosystem and climate tradeoffs (DellaSala et al. 2022c)

EARTH DAY CARPIE DIEM MOMENT FOR USA MOG

- National rulemaking merge EO 14008 (30 x 30) and 14072 (MOG inventory) to comply with White House "roadmap for nature-based solutions, Glasgow Forest Pledge, Paris Climate Agreement (Article 5.1), President's emissions reductions (~10% MOG logging savings) (DellaSala et al. 2022a, 2023)

- Use billions of forestry dollars in Infrastructure and Inflation Reduction Acts to surgically treat flammable logged areas (there's plenty to do in the degraded landscape)

- Climate Smart Management - Transition logging out of MOG and into previously logged/reforested areas as on the Siuslaw and Tongass National Forests (BLM needs to follow)

- Resilience and climate adaptation – protect MOG (carbon stock), biodiversity, clean water, fire refugia all rolled into one

- Protecting MOG from logging is a step towards 30 x 30 (nearly 2 dozen timber sales (climate-forests.org); 50M ac at risk to logging (~10% annual emissions savings) (DellaSala et al. 2022a)

Matureforests.org; wild-heritage.org

Partial list of publications

- Birdsey, R., et al. 2023. Assessing carbon stocks and growth potential of mature forests and larger trees in U.S. federal lands. Frontiers For. Glob. Change. https://doi.org/10.3389/ffgc.2022.1074508
- DellaSala, D.A., et al. 2015. Building on two decades of ecosystem management and biodiversity conservation under the Northwest Forest Plan, USA. Forests 6:3326-3352.
- DellaSala D.A, et al. 2022a. Mature and old-growth forests contribute to large-scale conservation targets in the conterminous United States. Front. For. Glob. Change 5:979528. doi: 10.3389/ffgc.2022.979528
- DellaSala, D.A., et al. 2022b. The Tongass National Forest, southeast Alaska, USA: a natural climate solution of global significance. Land 11 https://doi.org/10.3390/land11050717
- DellaSala, D.A., et al. 2022c. Have western USA fire suppression and active management approaches become a contemporary Sisyphus? Biological Conservation 268 https://doi.org/10.1016/j.biocon.2022.109499
- DellaSala, D.A. et al. 2023. A Carpe Diem Moment on US Forests and Climate Policy. Invited paper. J. Forest and Geosci 1:1=5

THANK YOU NASA (GEDI) AND USDA (FIA, FOREST-FAUCETS) FOR DATASETS USED IN ALL ANALYSIS