NITROGEN AND SULFUR DEPOSITION AT SELECTED FEDERAL CLASS I AREAS AND SENSITIVE CLASS II AREAS IN NEW MEXICO

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ACKNOWLEDGMENTS

- Bureau of Land Management

- NADP CLAD Science Committee

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OUTLINE

- Motivation

- Photochemical grid modeling with CAMx

- Sulfur and nitrogen deposition in selected Class I and sensitive Class II areas in New Mexico

- Comparison with empirical critical loads

- Source apportionment of nitrogen deposition

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MOTIVATION

• Federal Land Managers interested in understanding impacts of atmospheric deposition of sulfur and nitrogen compounds

- Federal Class I and Sensitive Class II areas:

National parks, forests, wilderness areas and wildlife refuges

NPS, USFS, FWS

ENVIRON

CAMx PHOTOCHEMICAL GRID MODEL

- Comprehensive Air Quality Model with Extensions (CAMx)
- Developed by Ramboll Environ and publicly distributed
- Used for federal rulemaking by EPA and for SIPs by states
- Also applied by other agencies, academia and consulting
- Advanced source apportionment methods for deposition precursors and other pollutants

- OSAT/APCA : Ozone source apportionment technology/ Anthropogenic Precursor Culpability Assessment

- PSAT : Particulate source apportionment technology (for PM and deposition)

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CAMx MODELING IN NEW MEXICO

- Model applied at 4 km horizontal grid spacing

- Emissions from anthropogenic and natural sources for two scenarios

- 2008 Base Scenario

  Evaluated using AQS, IMPROVE, CASTNET, NADP measurements

- 2021 Future Year Scenario

  Projected Air Quality and Air Quality Related Values (AQRV) impacts

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CAMx SOURCE APPORTIONMENT FOR AIR QUALITY AND AIR QUALITY RELATED VALUES (AQRV)

- AQRV

  - Deposition – **Focus of this presentation**

  - Atmospheric visibility

- Air Quality

  - Ozone

  - $PM_{2.5}$ and PM_{10}

  - NO_2, SO_2 , CO, NH_3

CHEMISTRY AND DEPOSITION

- Sulfur compounds

  SO_2, PM SO_4

- Nitrogen compounds

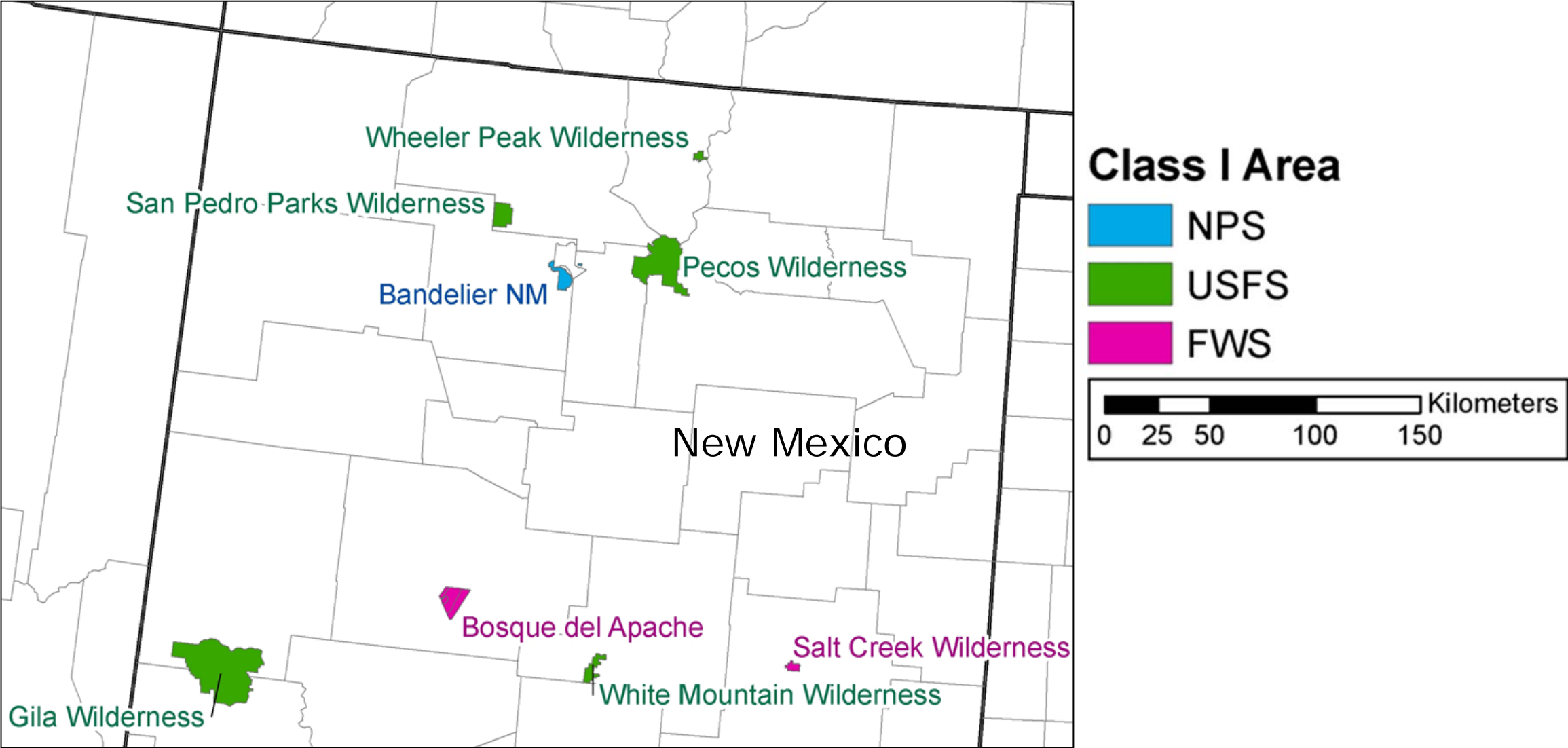 NOx (NO, NO_2)

  Inorganic nitrate (HNO_3, PM NO_3)

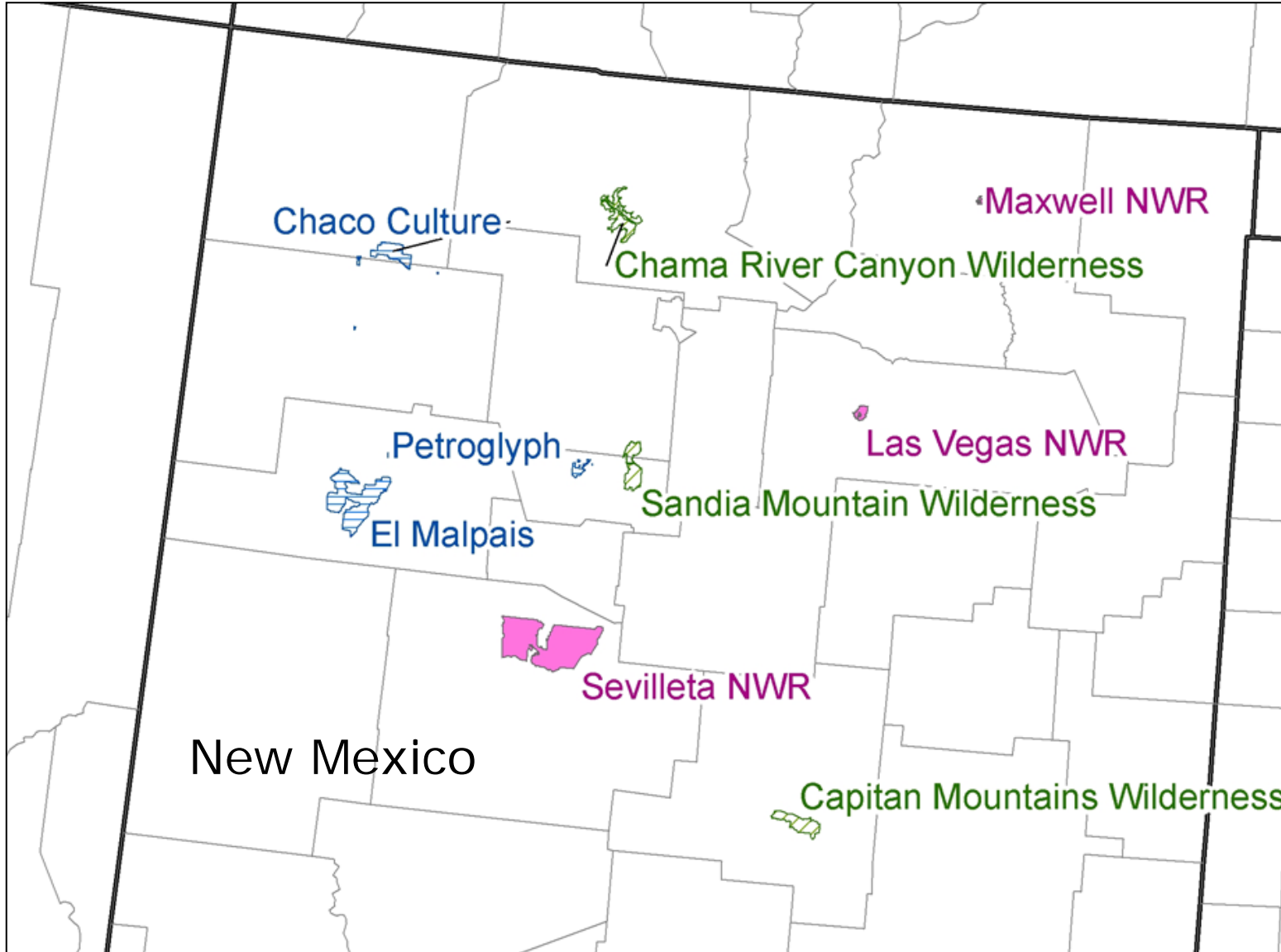 Other NOz (N_2O_5, HNO_2, HNO_4)

  Organic nitrates: PAN, PANX, NTR

  Reduced nitrogen: NH_3, PM NH_4^+

- Sulfur and Nitrogen deposition at Class I and sensitive Class II areas

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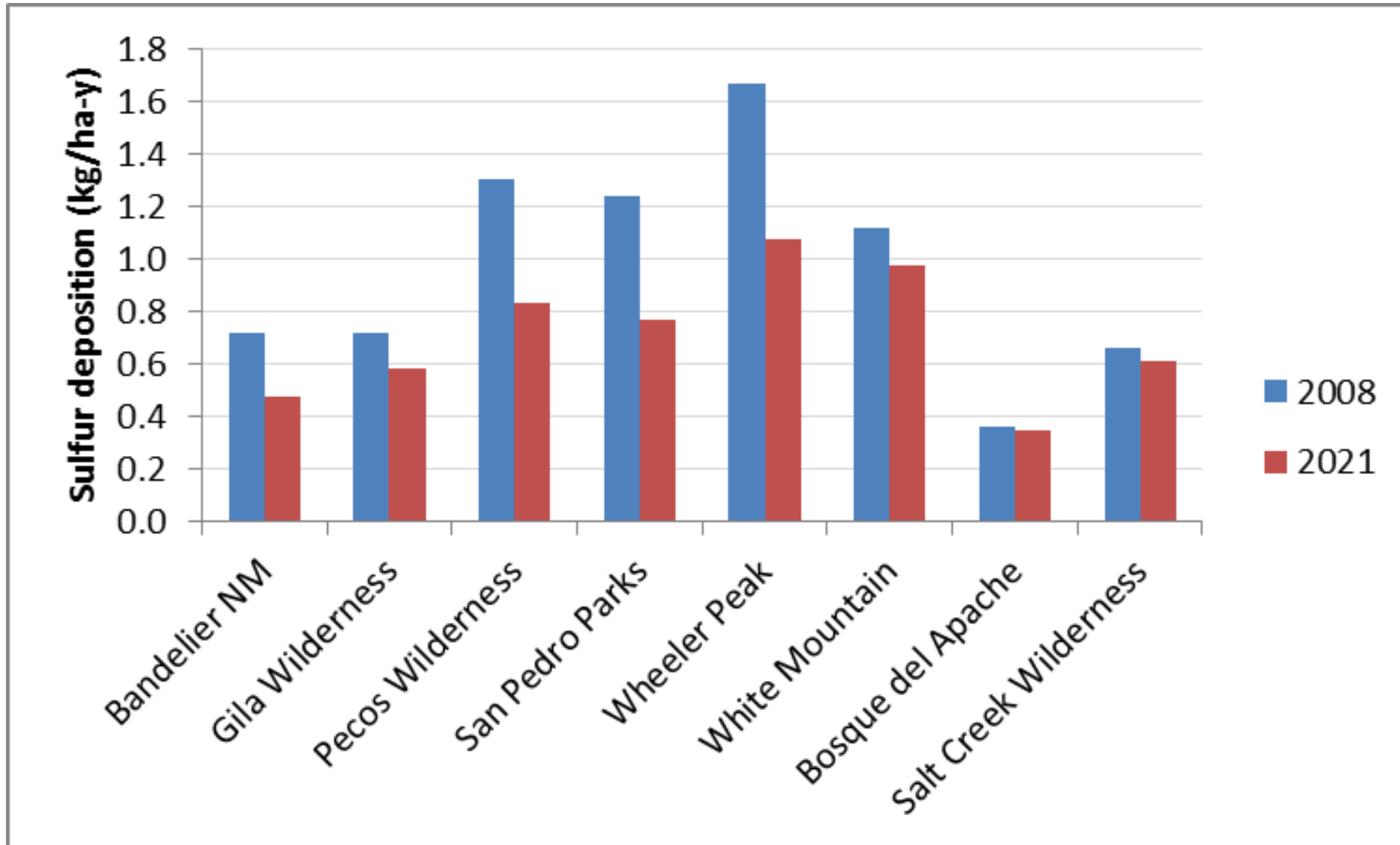# SELECTED FEDERAL CLASS I AREAS

SELECTED SENSITIVE CLASS II AREAS

AVERAGE SULFUR DEPOSITION AT CLASS I AREAS

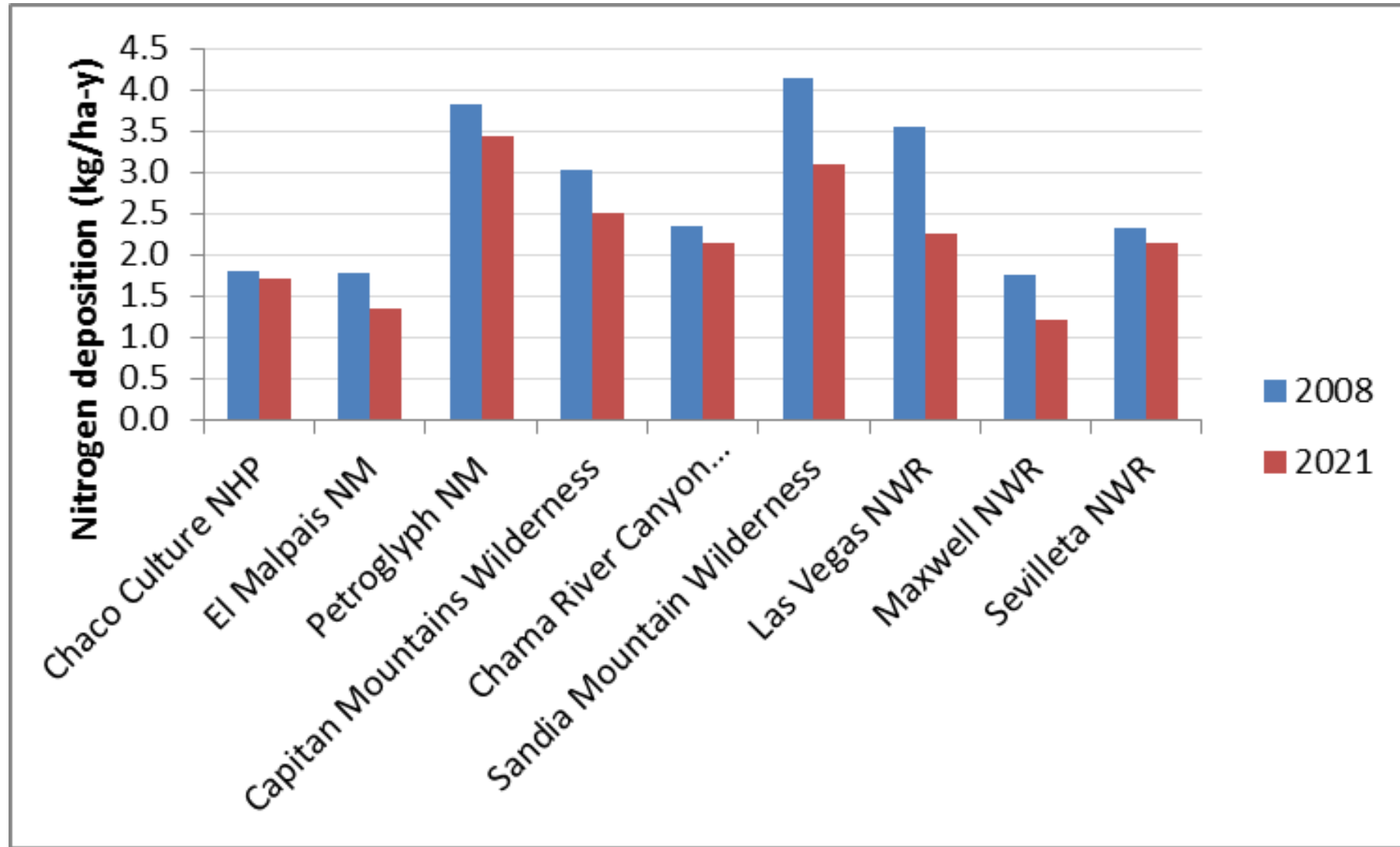RAMBOLL ENVIRON

AVERAGE SULFUR DEPOSITION AT SENSITIVE CLASS II AREAS

RAMBØLL ENVIRON
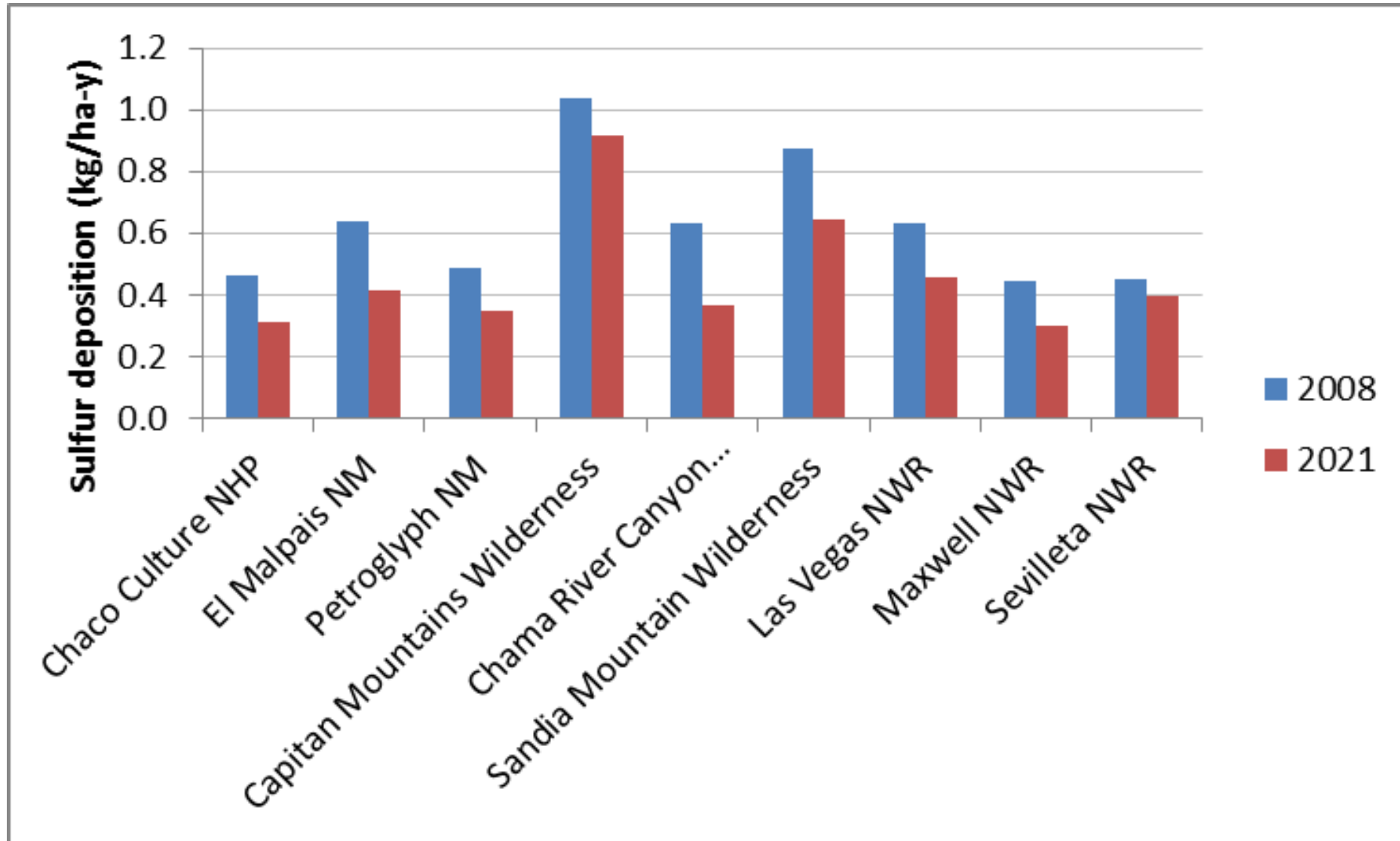
AVERAGE NITROGEN DEPOSITION AT CLASS I AREAS
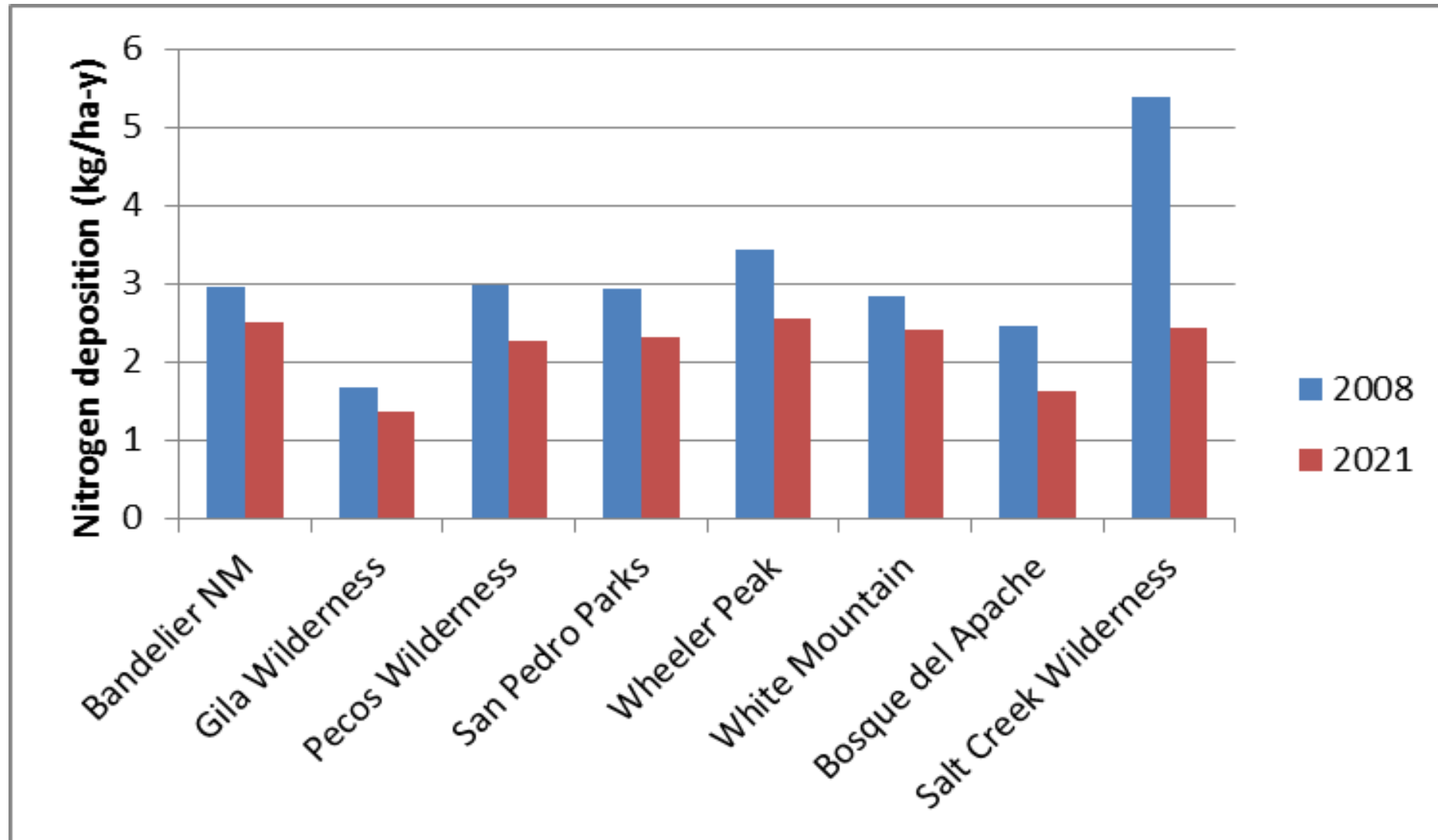
AVERAGE NITROGEN DEPOSITION AT SENSITIVE CLASS II AREAS

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EMPIRICAL CRITICAL LOADS OF NITROGEN

- Pardo et al., 2011

- Diverse ecoregions in New Mexico

  - North American Deserts

  - Northwestern Forested Mountains

  - Temperate Sierras

  - Great Plains

- Empirical critical loads for nitrogen deposition (kg ha^{-1} y^{-1})

Ecoregion type	Herbac. Plants Min CL	Herbac. Plants Max CL	Lichen Min CL	Lichen Max CL	Mycorrhizal Fungi Min CL	Mycorrhizal Fungi Max CL
N. American Deserts	3.0	8.4	3.0	3.0		
NW Forested Mtns	4.0	10.0	2.5	7.1	5.0	10.0
Temperate Sierras			4.0	7.0		
Great Plains	5.0	25.0			12.0	12.0

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COMPARISON WITH EMPIRICAL CRITICAL LOADS OF NITROGEN
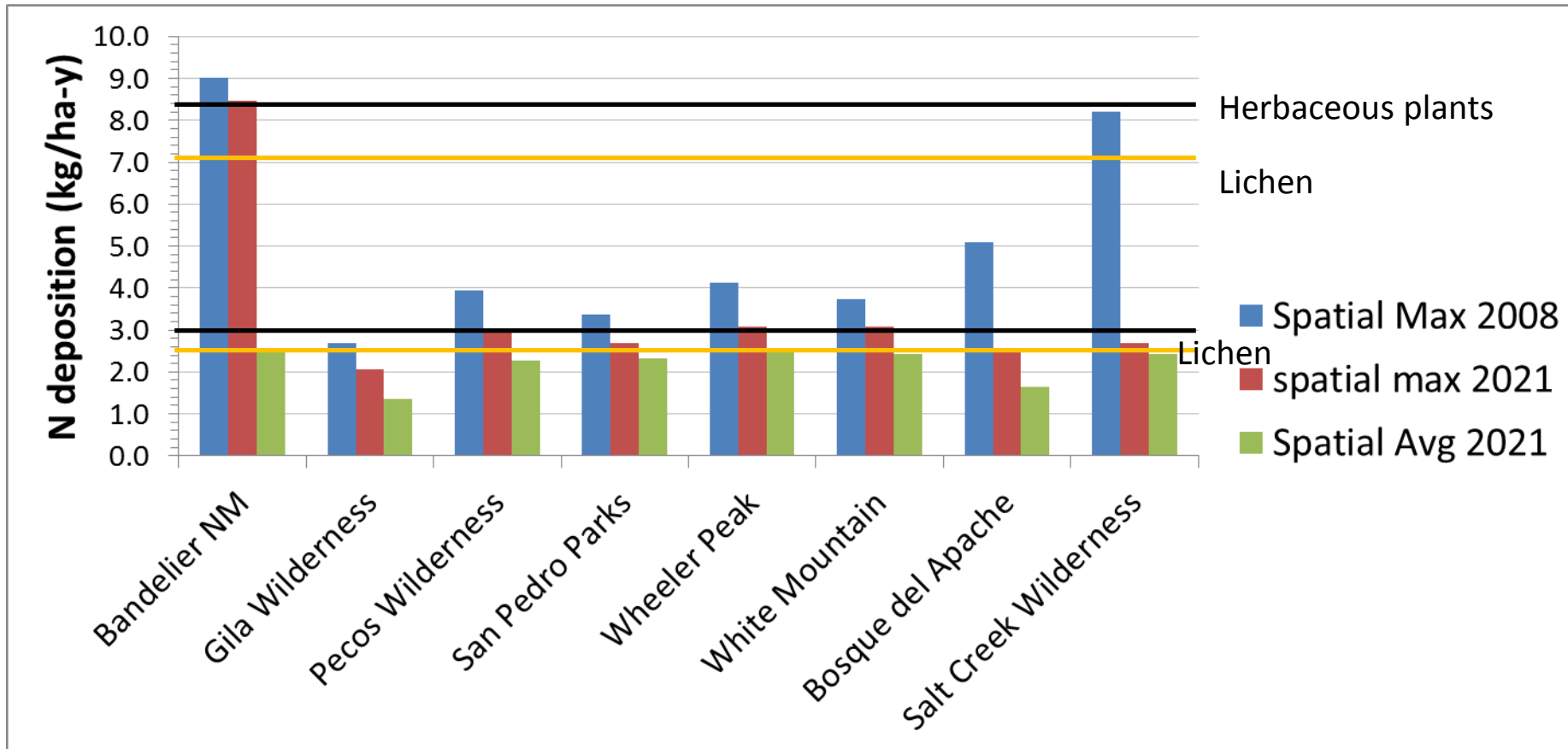
Empirical critical loads of N from Pardo et al., 2011

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TYPICAL SOURCE APPORTIONMENT CATEGORIES

- Power plants (EGUs)

- Oil and natural gas development

- Other point anthropogenic sources

- Other area anthropogenic sources

- Mobile sources

- Natural emission sources

- Boundary conditions

Some categories are combined here

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DEPOSITION SOURCE APPORTIONMENT

- Nitrogen deposition source apportionment with CAMx at Pecos Wilderness Class I area
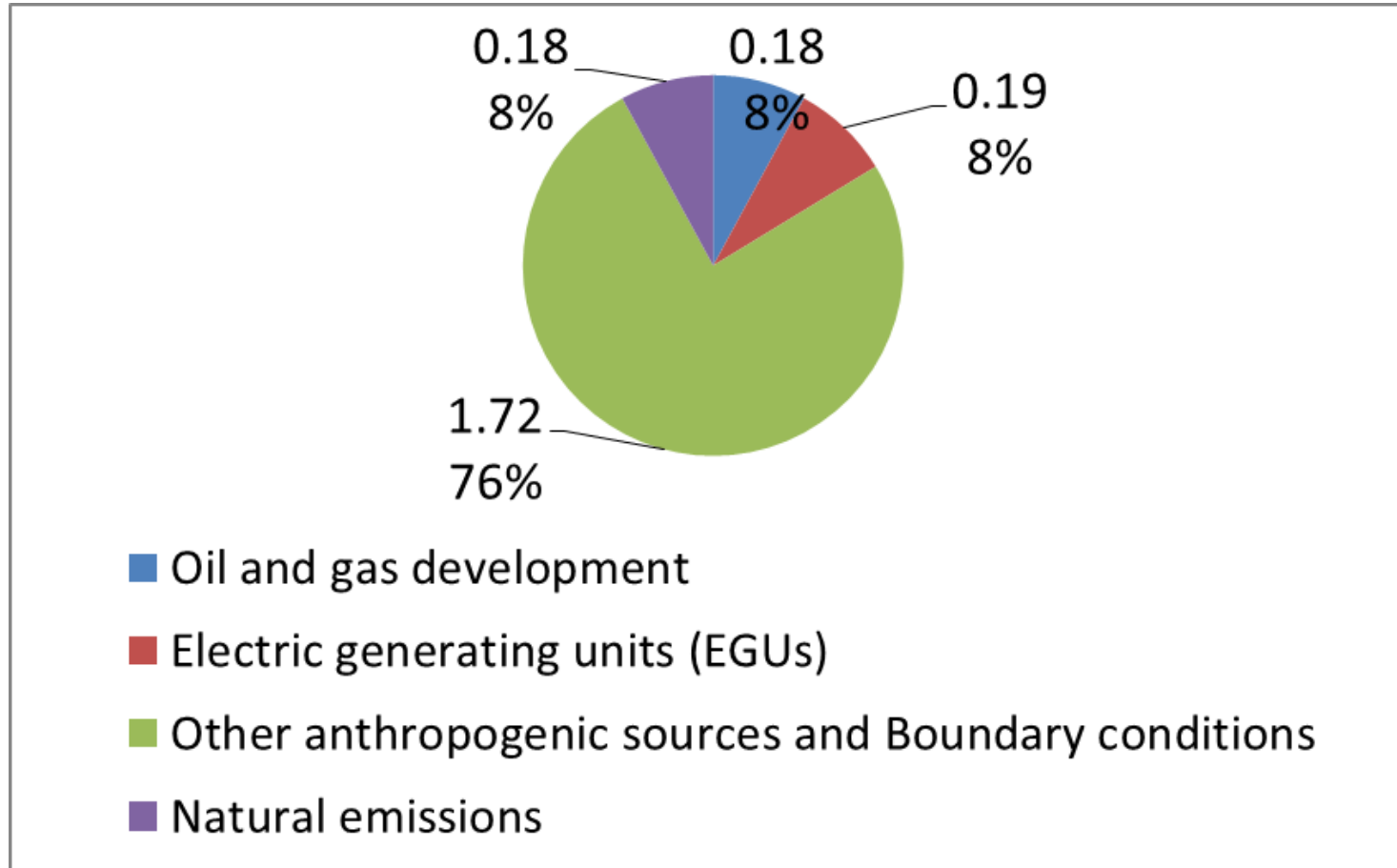
Annual N deposition (kg/ha)

and % of total

Preliminary results, do not cite

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DEPOSITION SOURCE APPORTIONMENT

- Nitrogen deposition source apportionment with CAMx at Bandelier National Monument Class I area

Oil and gas development

Electric generating units (EGUs)

Other anthropogenic sources and Boundary conditions

Natural emissions (wildfires + biogenic)

Annual N deposition (kg/ha)

and % of total

Preliminary results, do not cite

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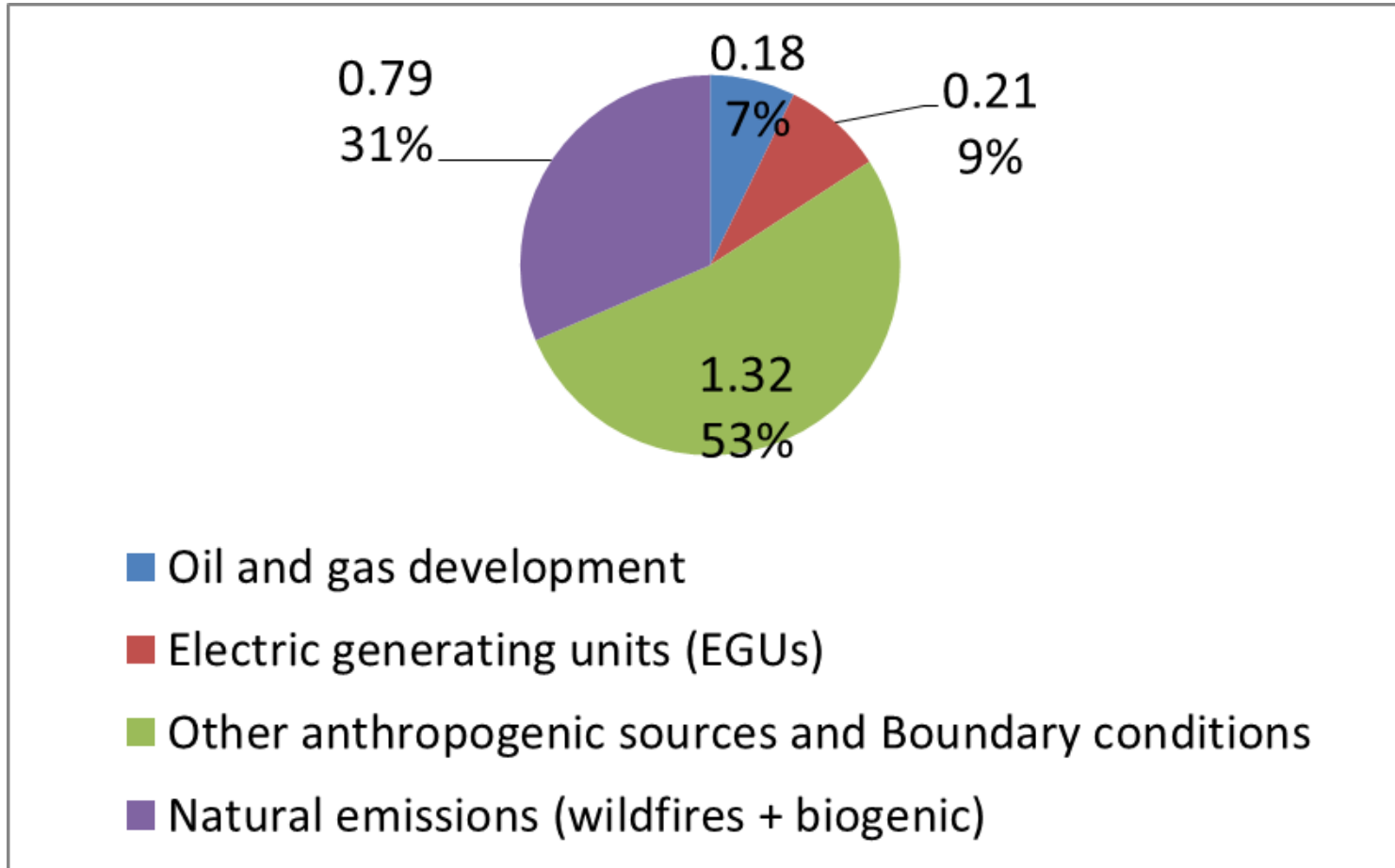
SUMMARY

- CAMx model offers powerful tools for understanding sulfur and nitrogen deposition impacts at Class I and sensitive Class II areas

QUESTIONS ON THIS PRESENTATION

Contact Krish at

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DISCLAIMER

- Results presented here are preliminary

- The views and conclusions presented here represent only those of the authors and not of any other organization or agency.

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