

Critical Zone Research in Action: Polynesian agriculture as a bioassay for pedogenic thresholds

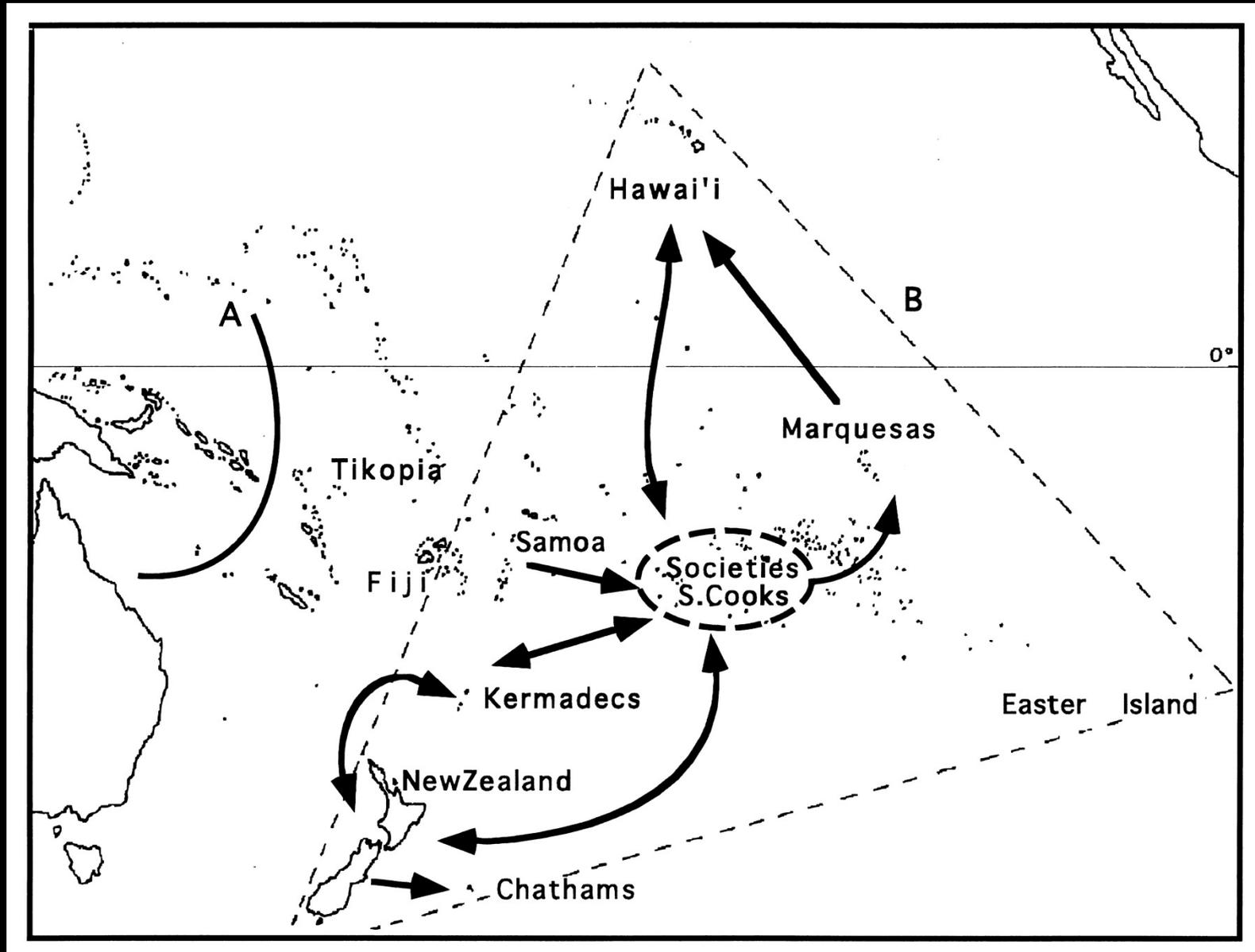
Oliver Chadwick, UC Santa Barbara



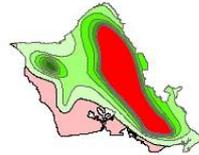
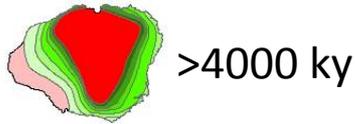
Patrick Kirch, UC Berkeley

Peter Vitousek, Stanford

Polynesians: Seafaring Farmers

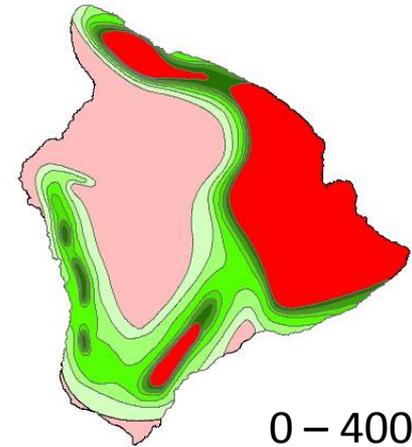
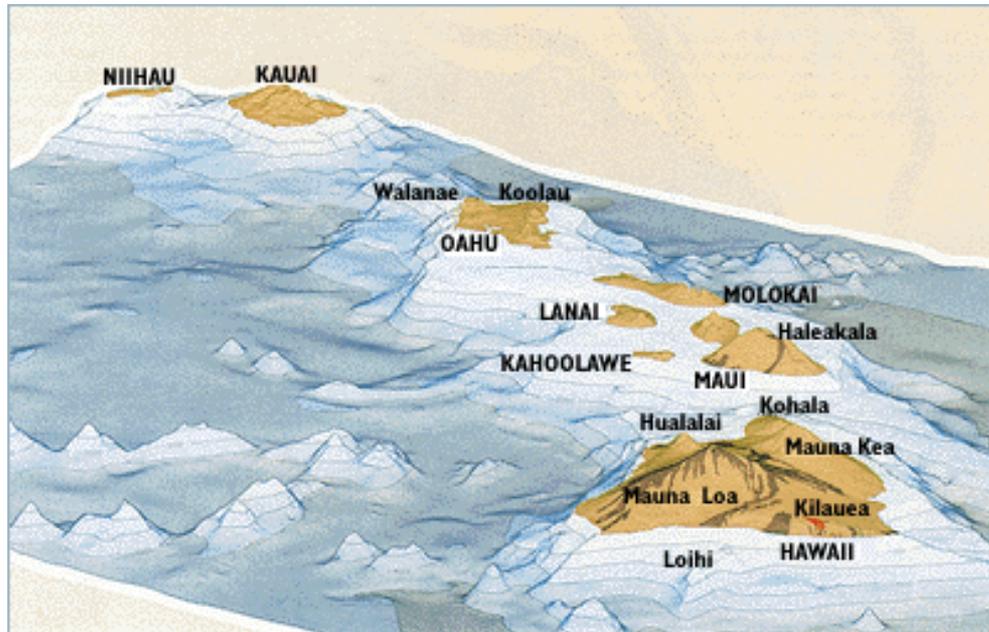
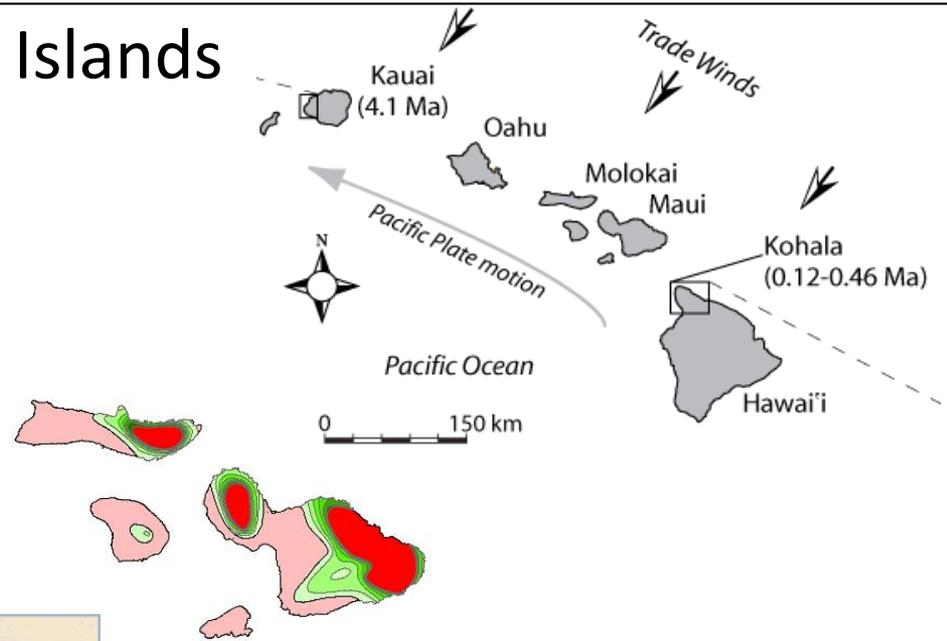
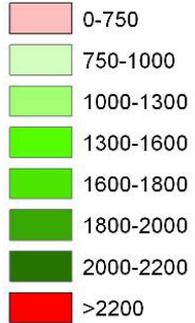


Hawaiian Islands



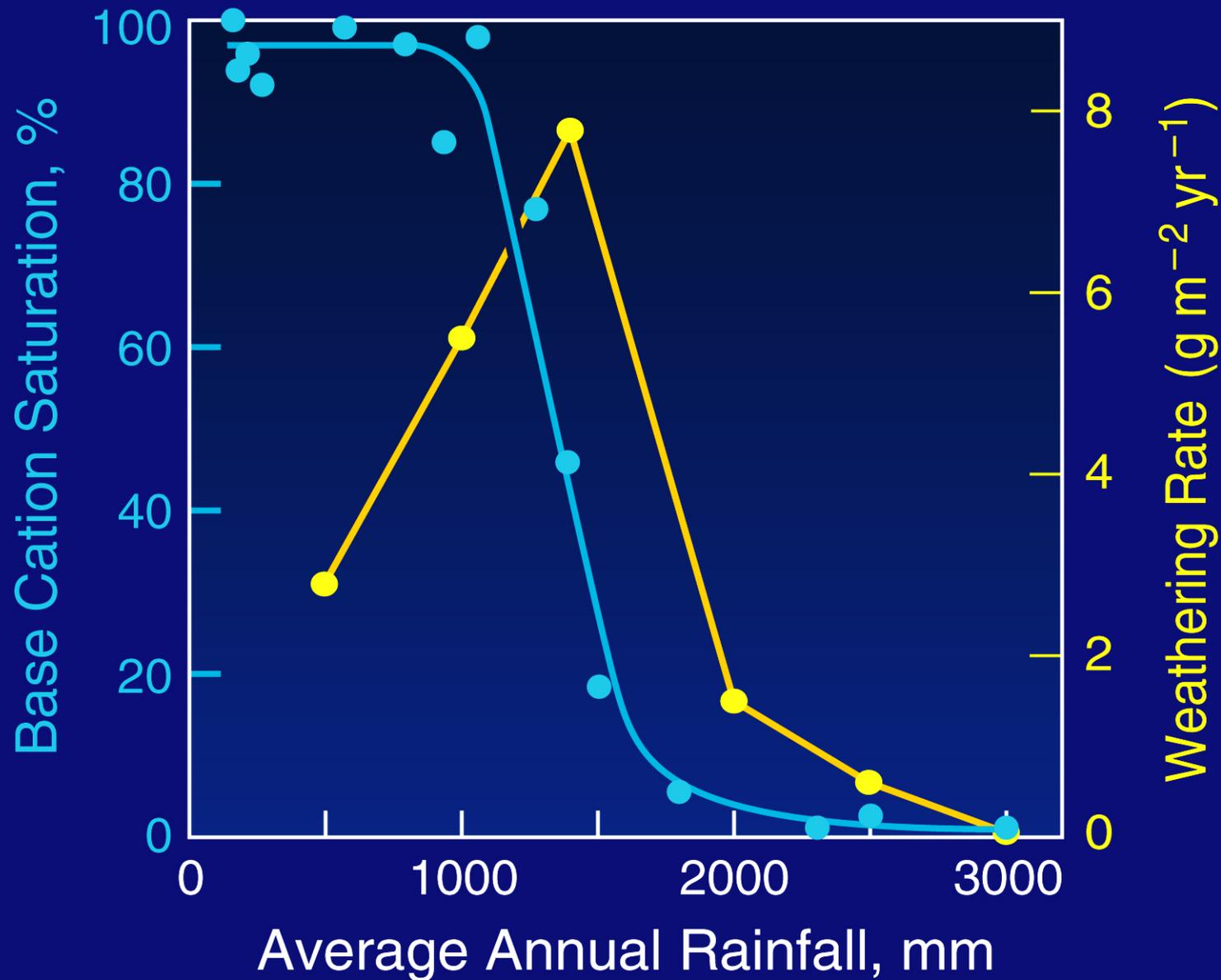
Rain

mm annual rainfall

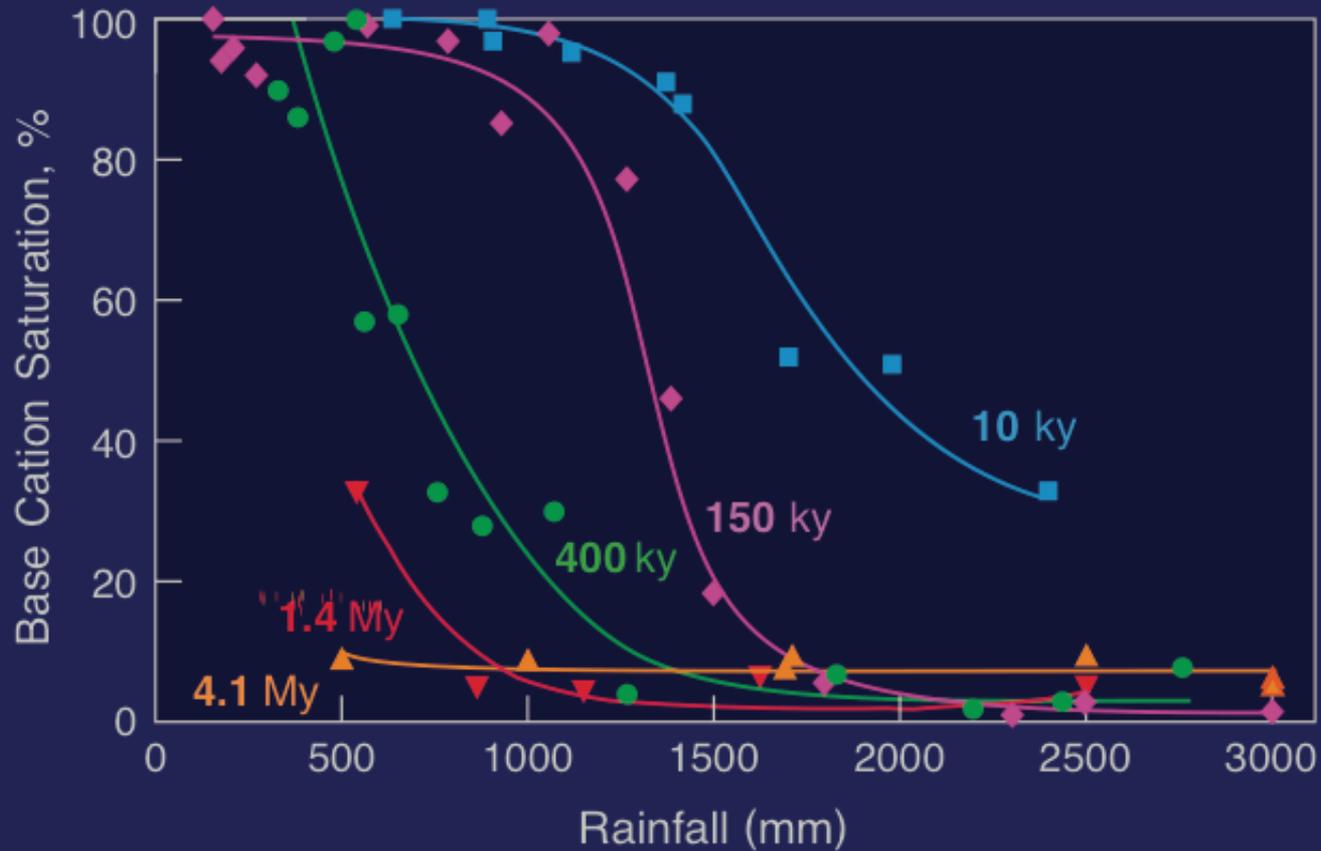


0 - 400 ky

150 ky climosequence: nutrients and weathering



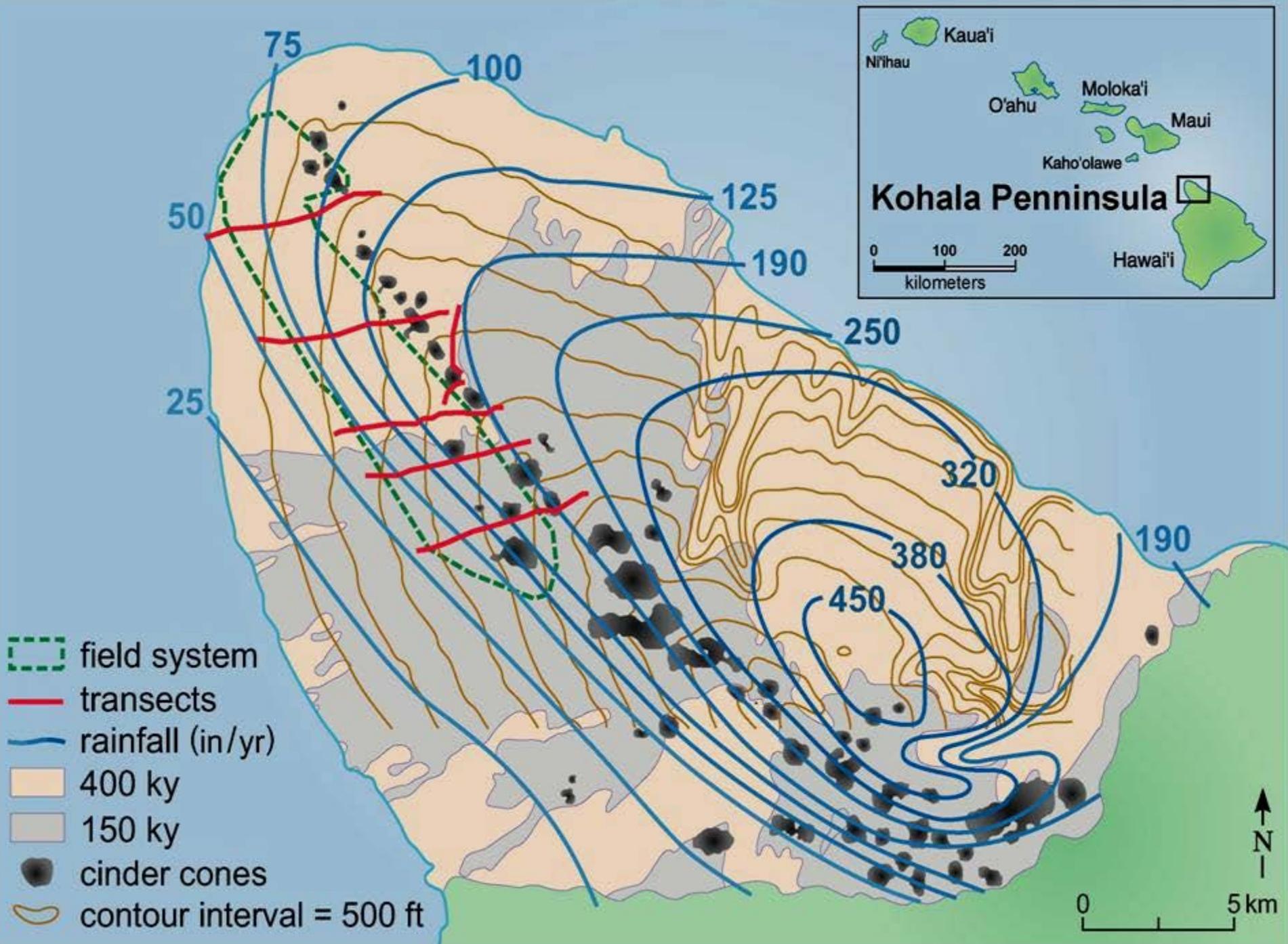
Chronosequence of Climosequences: base cation status



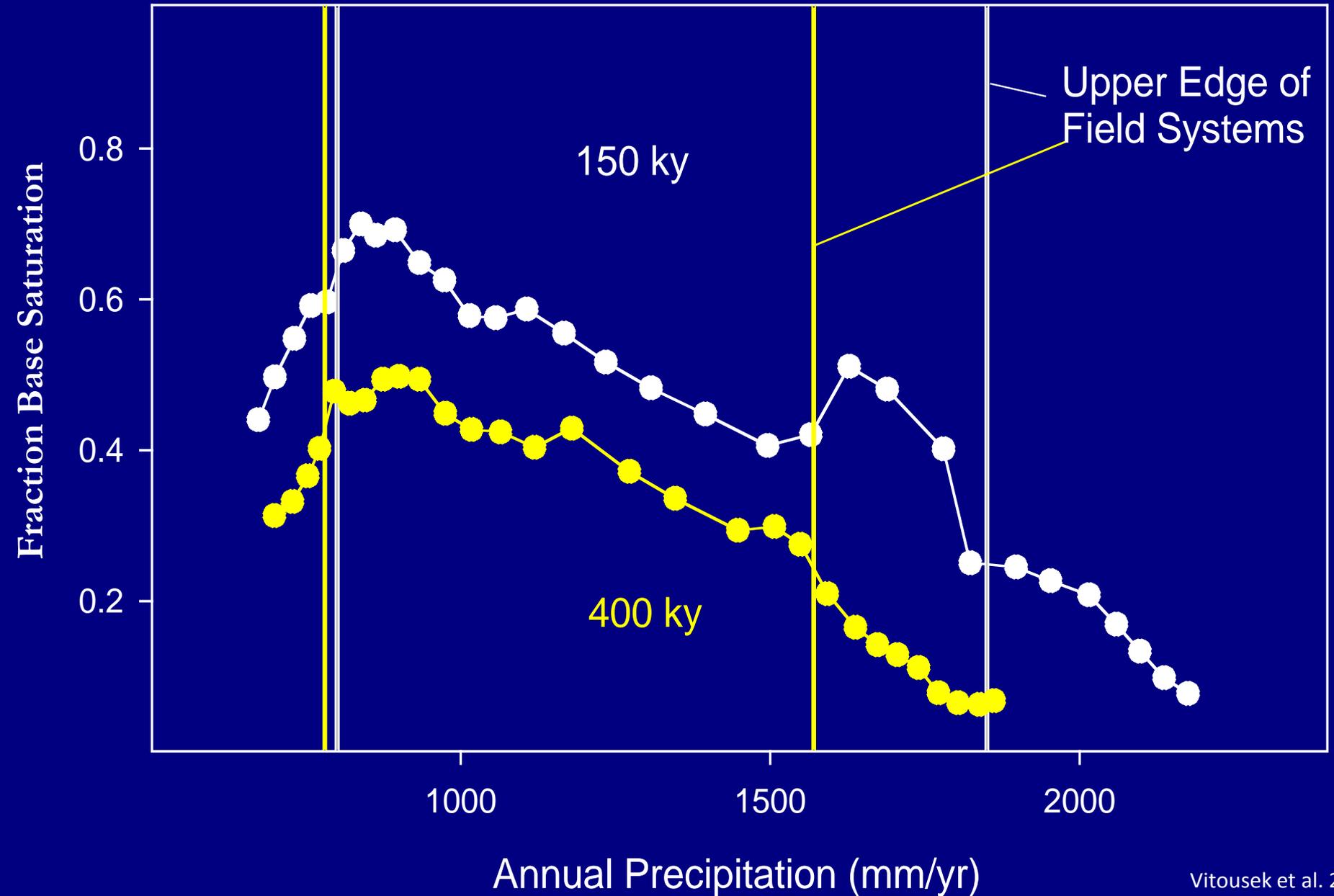
Environmental Control on Polynesian Agriculture

Leeward Kohala
pre-contact
Rain-fed fields
covered 60 km²

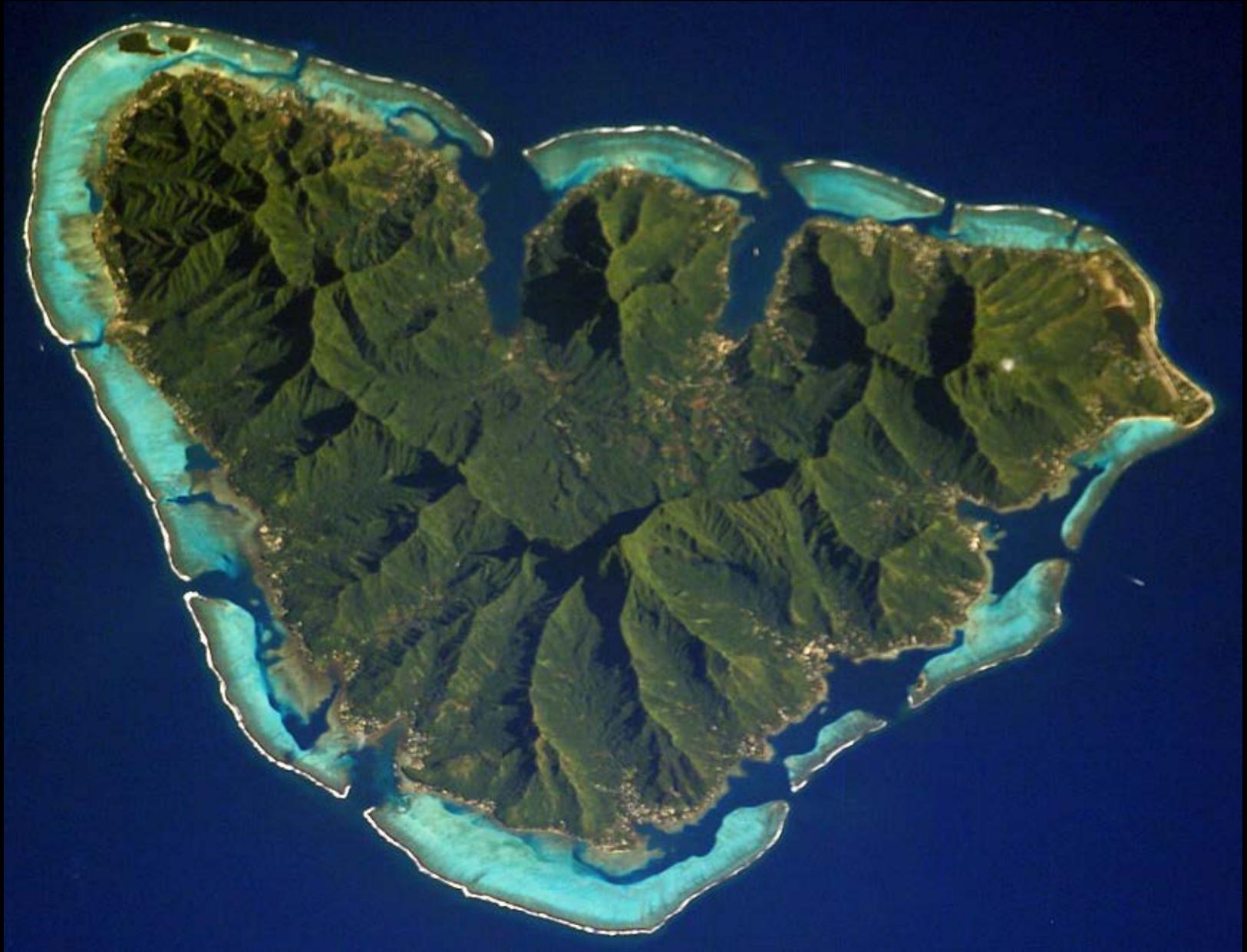




Farming the Rock – Dryland Agriculture



Moorea, Society Islands

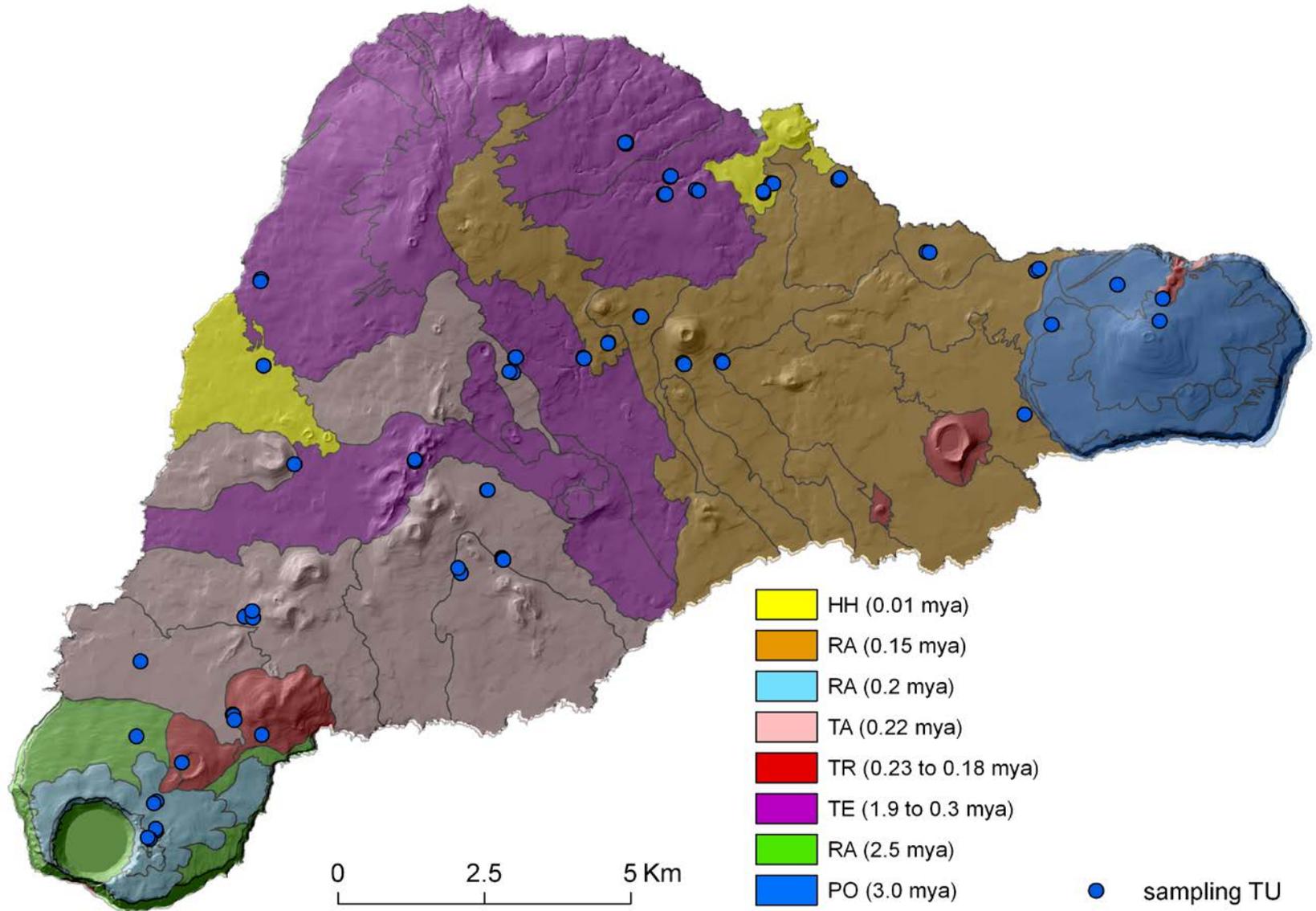




'OPUNOHU VALLEY, MO'OREA
'AMEHITI, Zone B
 P. KIRCH
 J. HOLSON
 T. TEINAURI
 22.VIII.07

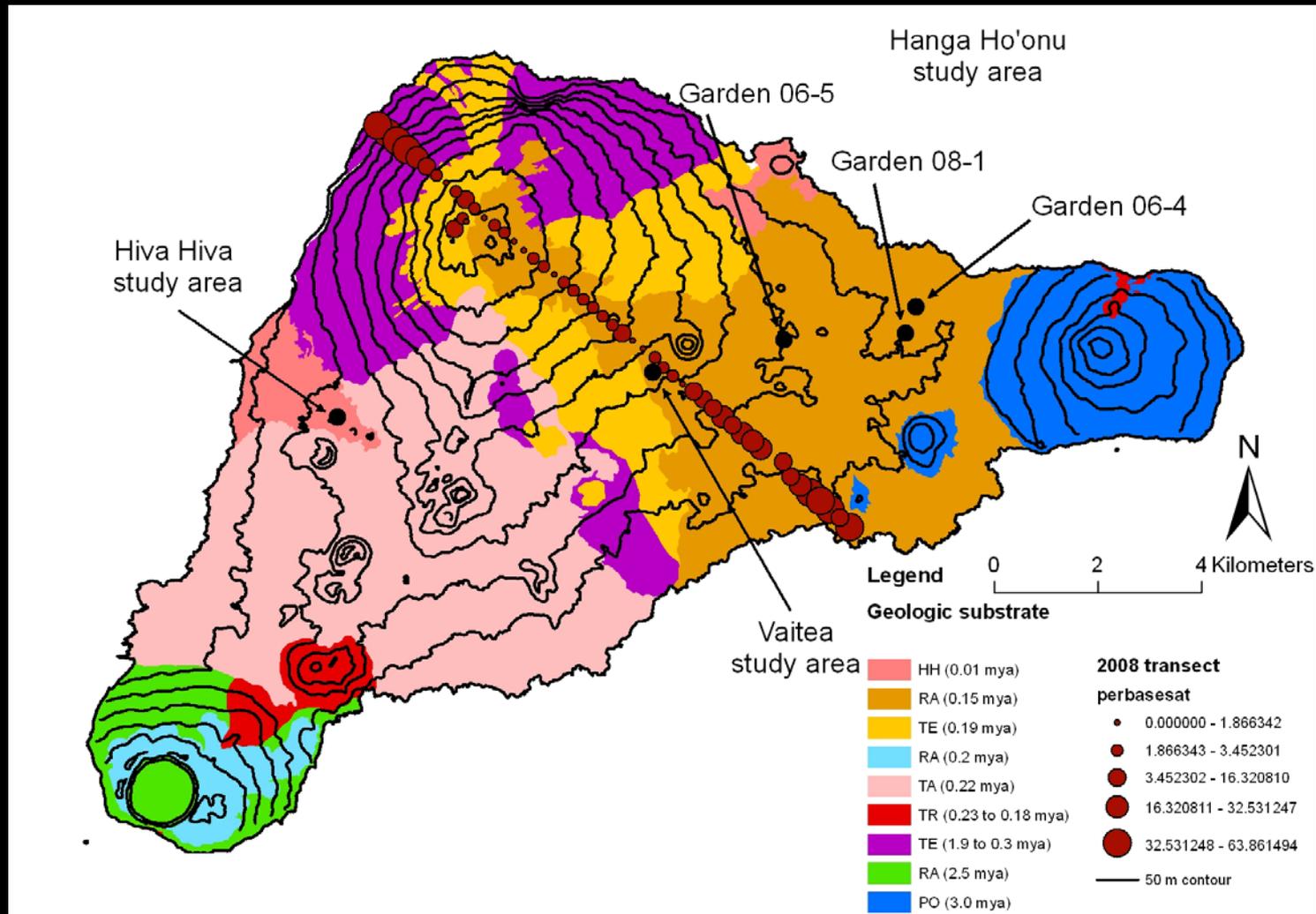
 Rocky Soil Area
 Base Saturation %

Rapa Nui

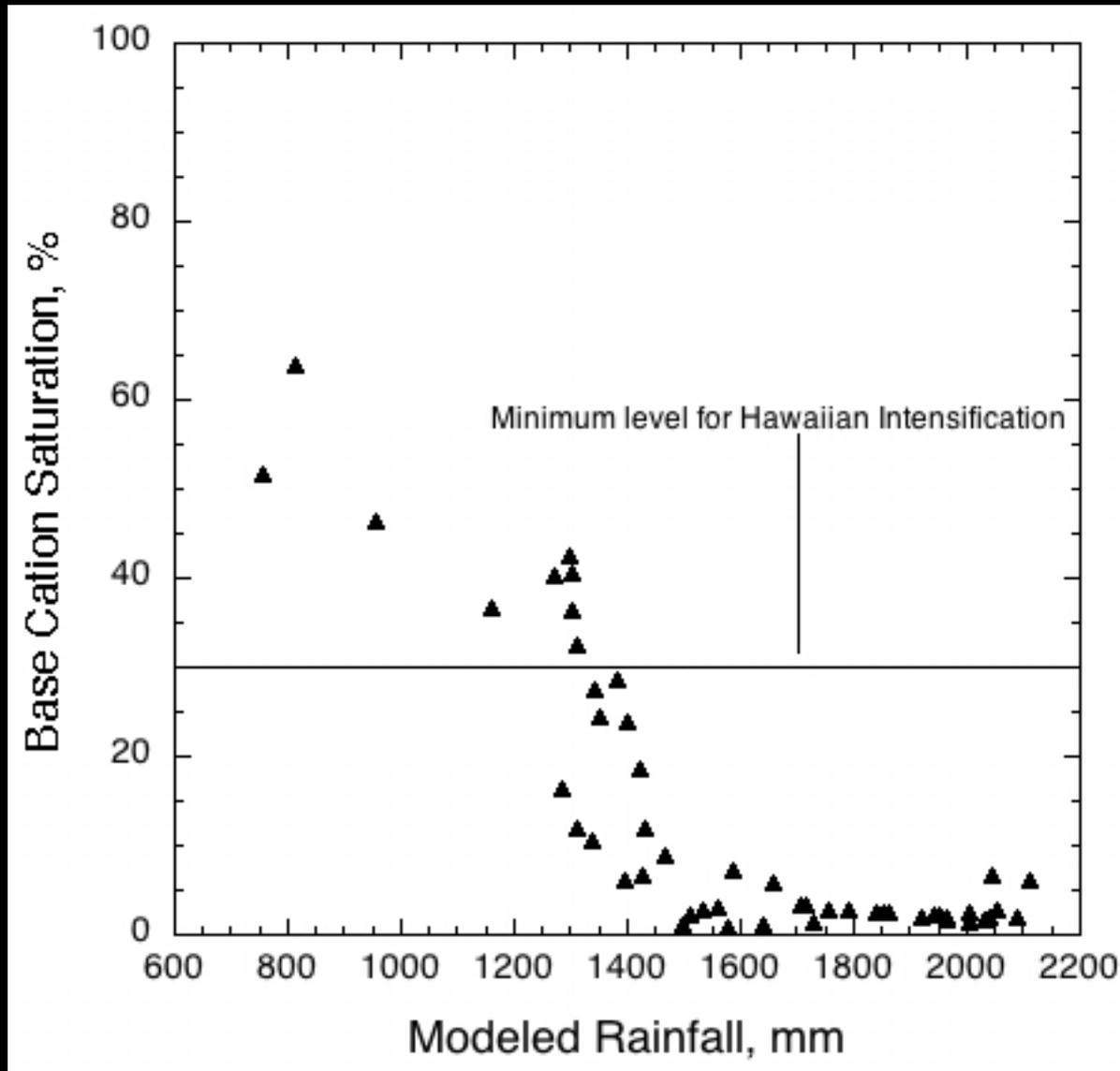


Easter Island Soil Nutrients

400 samples: average %BS = 18 ± 13
range in %BS = 1 - 64



Rainfall control of base saturation on Rapa Nui



Summary

- Analyses from Hawaii show that plant nutrient supply is constrained by lava flow age and by rainfall
- Moorea: dryland agriculture restricted to recent rock slide areas – true also for the Gambier Islands
- Rapa Nui: dryland agriculture was restricted by low nutrient supply and required more intensive agricultural efforts (rock mulching, etc)
- What we don't know is the extent to which Polynesians may have mined existing resources such as P accumulated as seabird guano

Hawaii as a Critical Zone Network

Soil Chemical Process Domains and Pedogenic Thresholds

