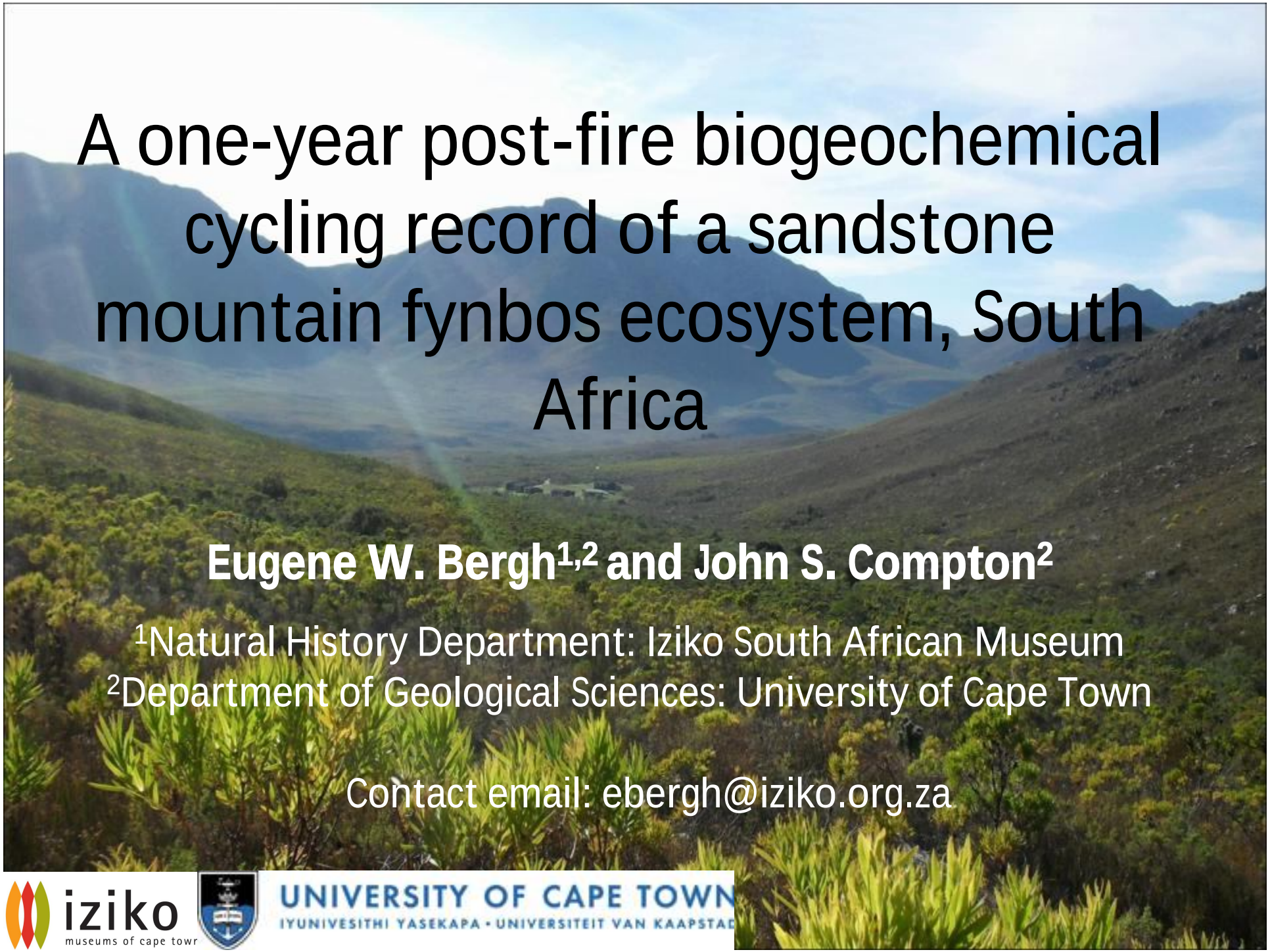


A one-year post-fire biogeochemical cycling record of a sandstone mountain fynbos ecosystem, South Africa

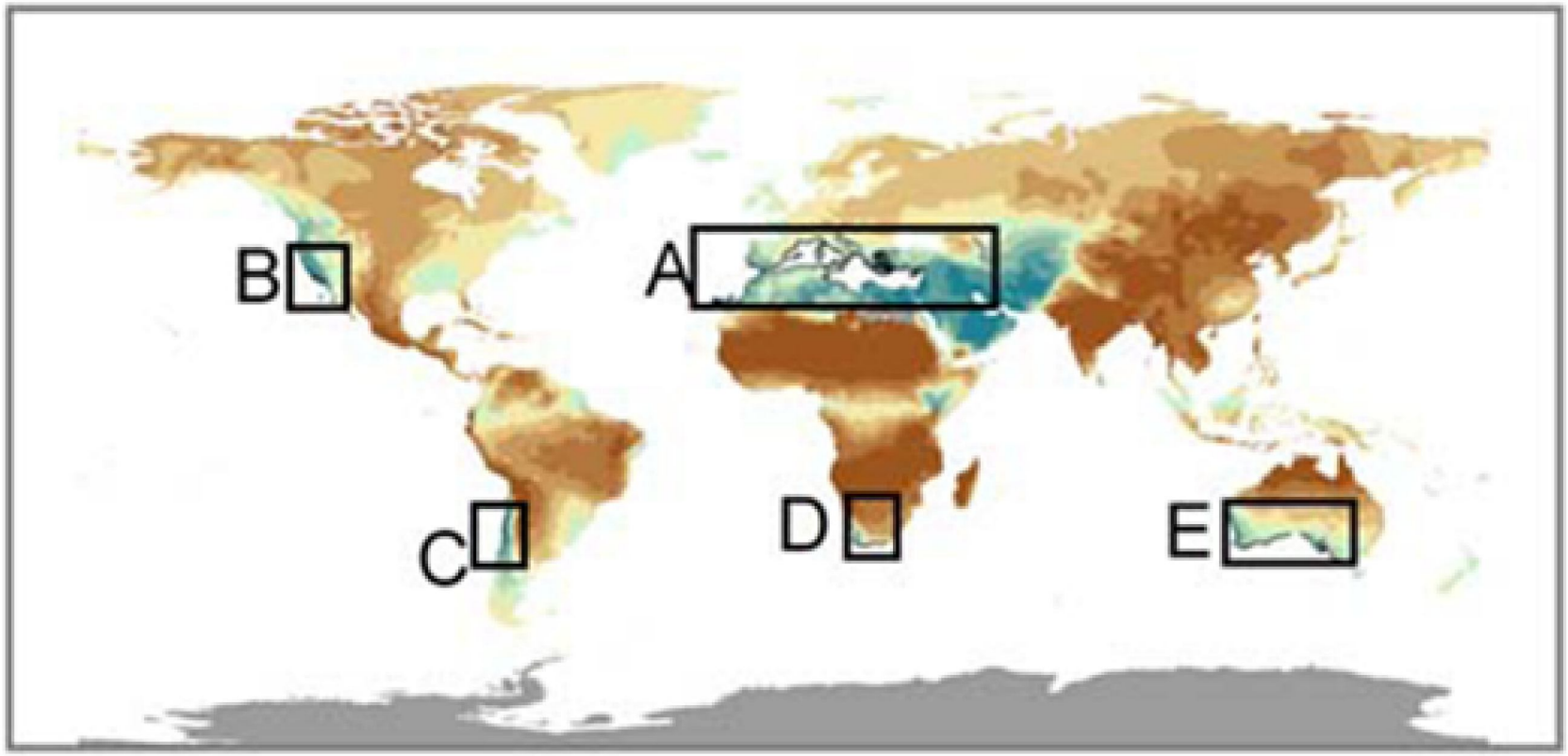
Eugene W. Bergh[1,2] and John S. Compton[2]

[1]Natural History Department: Iziko South African Museum
[2]Department of Geological Sciences: University of Cape Town

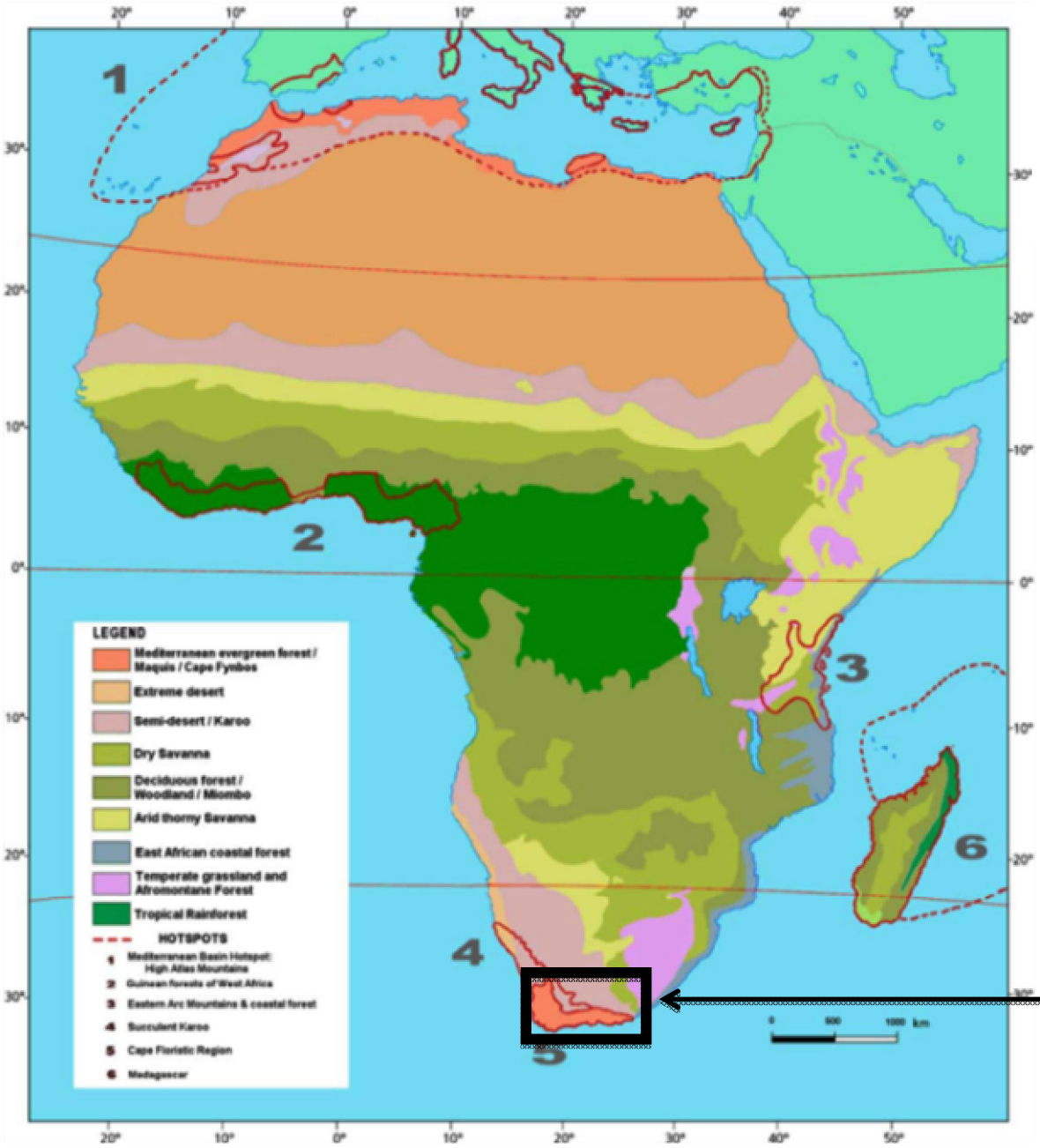
Contact email: ebergh@iziko.org.za

iziko museums of cape town

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD



Mediterranean ecosystems of the world.
From Klausmeyer and Shaw, 2009, *Mediterranean Climate Change*, **4** (7), 1-9



Burgoyne *et al*., 2005, *Journal of African Earth Sciences*, **43**, 13-52

Fynbos Biome

Objectives

- Determine total deposition and fluxes after a fire event in a fynbos ecosystem.
- Determine behaviour and cycling of nutrients/ions in ecosystem components.

How can such a diverse plant ecosystem thrive on thin, nutrient-poor soils?

Considering Components of the Ecosystem

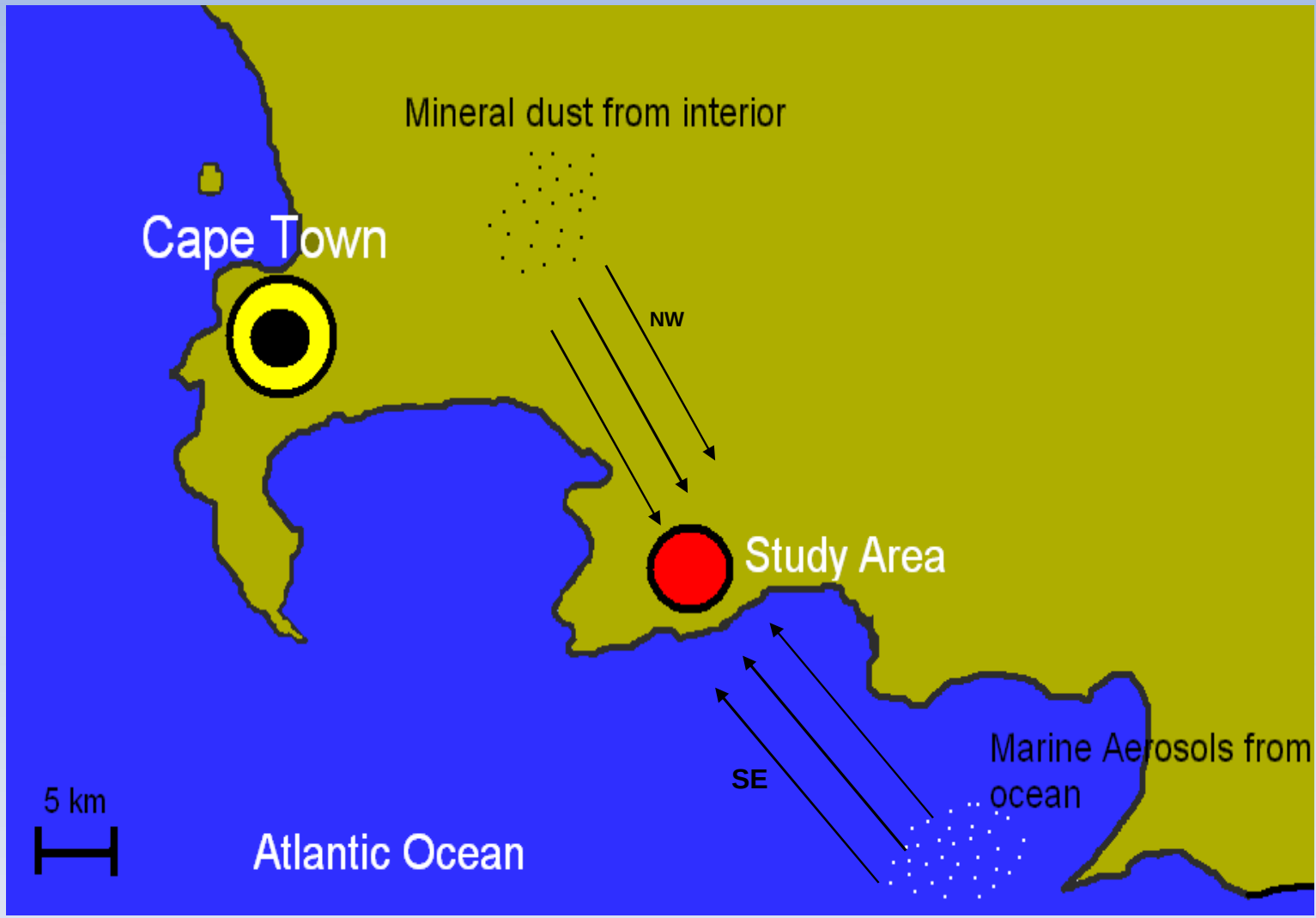
Atmospheric Total Deposition

Streams / Seeps

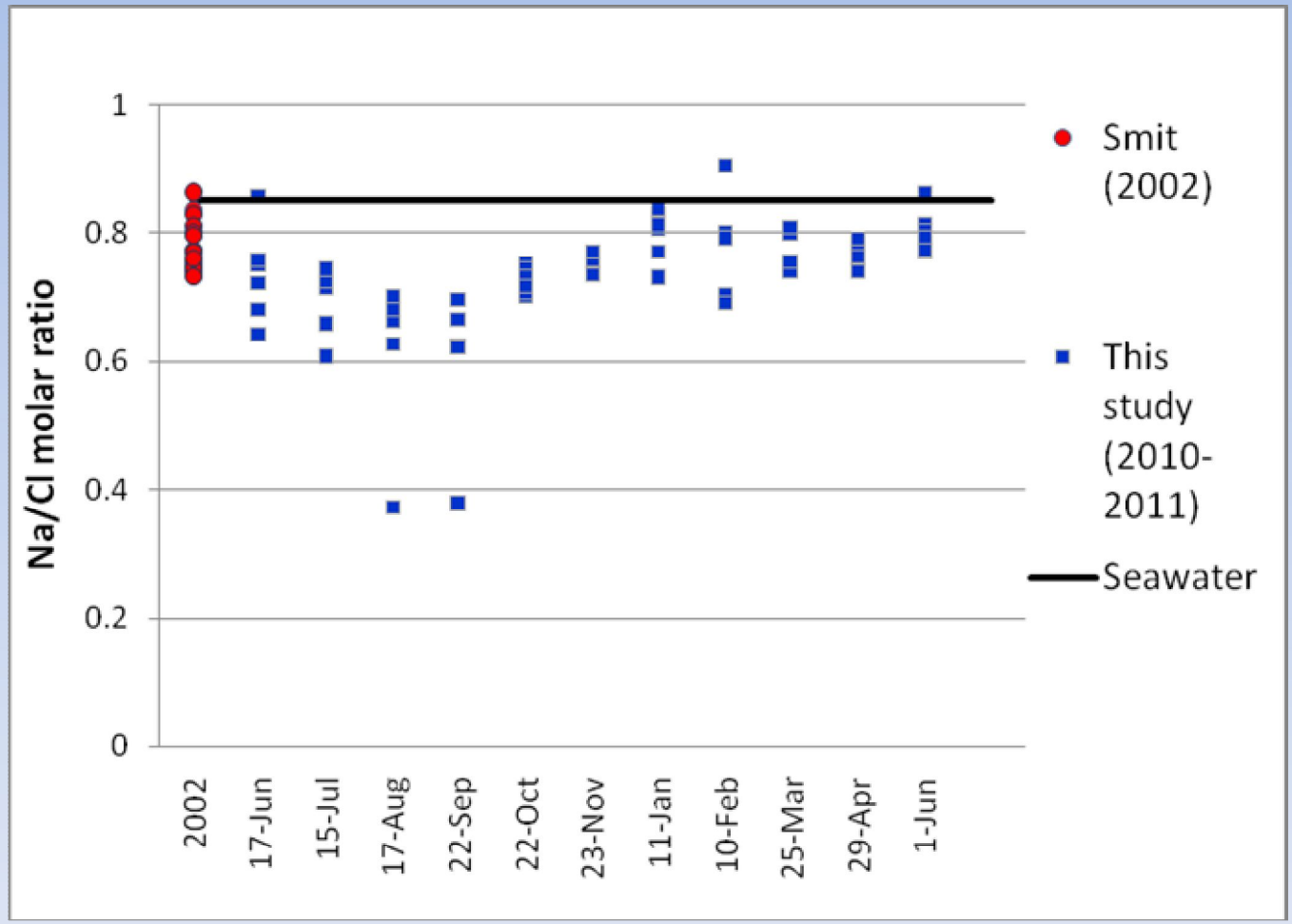
Soils

Bedrock

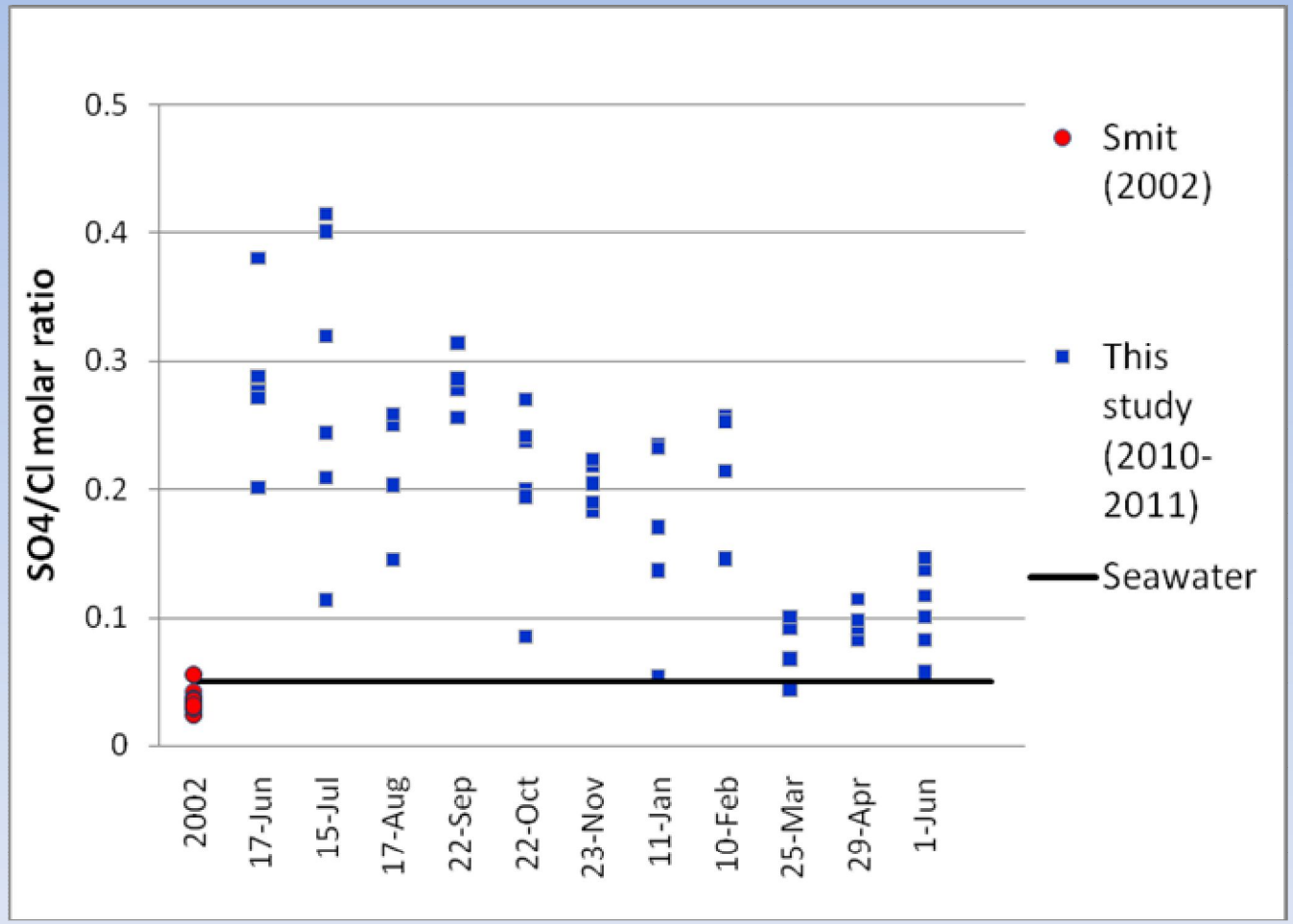
Delivery of Nutrients



Cl and Na almost exclusively marine in stream water



SO_4, Mg, Ca and K Results Reflect Mixed Sources in stream water



Cl, Na and K recorded a net loss

Total Deposition

Flux in (in kg/ha/yr)

Cl 50.0

Na 22.8

K 2.5

Outflow
Flux out

(in kg/ha/yr)

Cl 54.1

Na 25.0

K 3.2

Topsoil reservoir

(in kg/ha)

Na 72.6

K 226.5

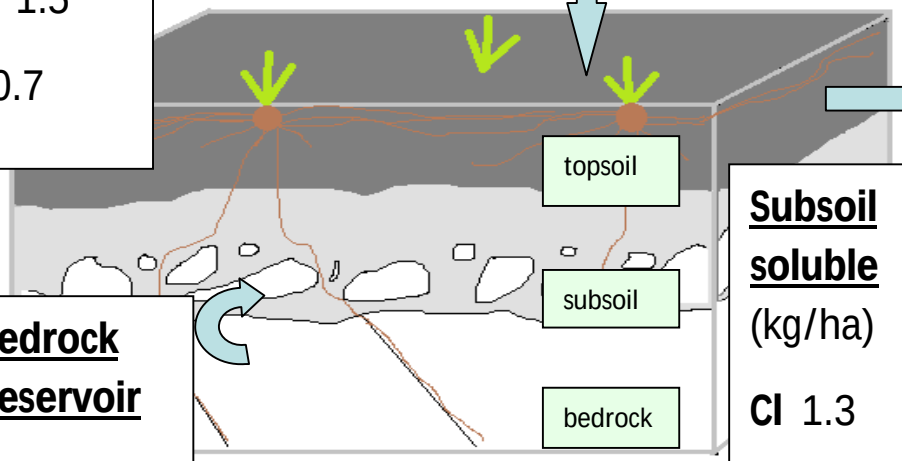
Topsoil soluble

(in kg/ha)

Cl 1.9

Na 1.5

K 0.7



Subsoil soluble

(kg/ha)

Cl 1.3

Na 1.3

K 0.6

Subsoil reservoir

(kg/ha)

Na 99.6

K 204.5

Bedrock Weathering

(kg/ha/myr)

Na 0.8×10^{-3}

K 1.3×10^{-3}

Bedrock Reservoir

(in kg/ha)

Na 356

K 1936

SO_4, Mg and Ca recorded net gains

Total Deposition

Flux in (in kg/ha/yr)

SO_4 55.3

Mg 7.4

Ca 4.3

Outflow Flux out

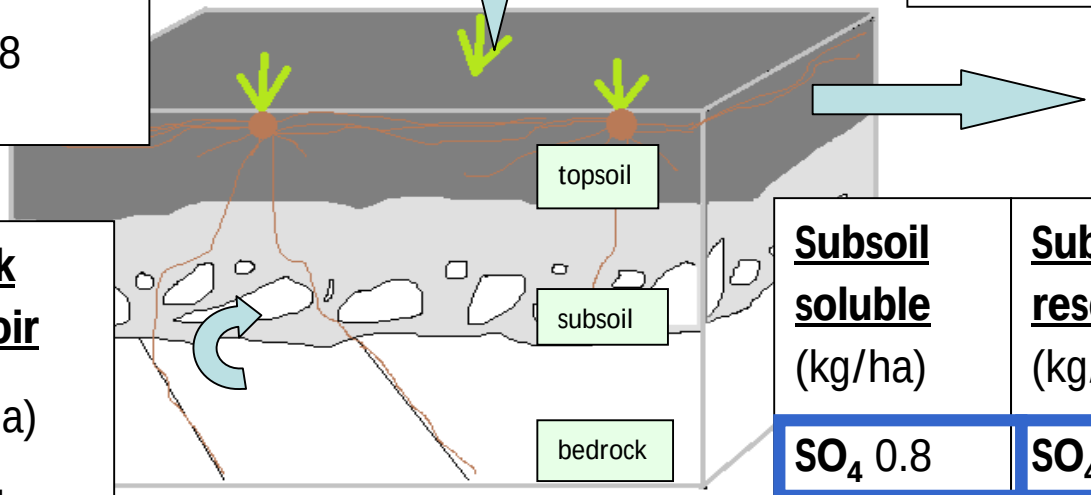
(kg/ha/yr)

SO_4 29.6

Mg 3.2

Ca 3.0

Topsoil reservoir (kg/ha)	**Topsoil soluble** (in kg/ha)
SO_4 1494.9	**SO_4** 0.9
Mg 147.3	**Mg** 0.7
Ca 851.4	**Ca** 0.8



Bedrock Weathering (kg/ha/myr)	**Bedrock Reservoir** (in kg/ha)
SO_4 1 x 10^{-3}	**SO_4** 464
Mg 0.4 x 10^{-3}	**Mg** 272
Ca 0.2 x 10^{-3}	**Ca** 464

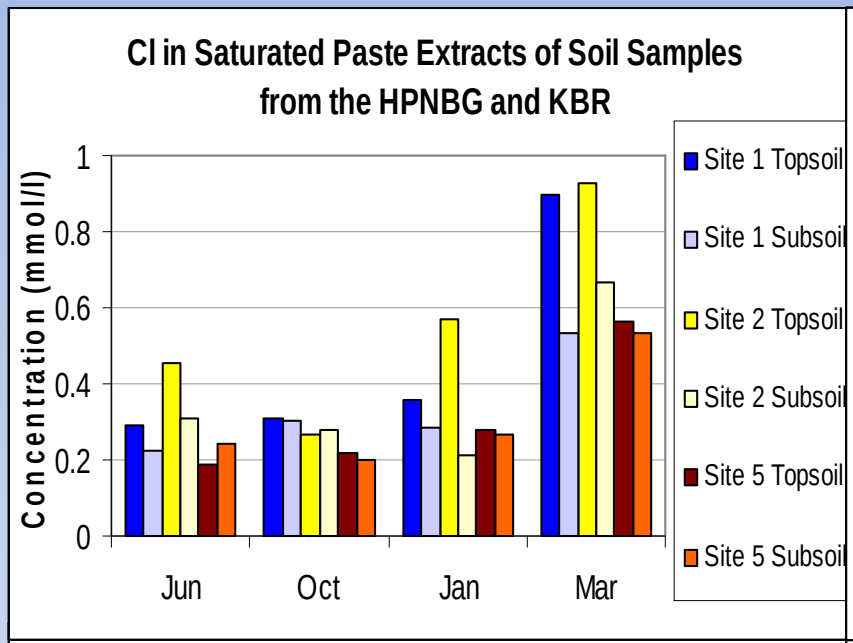
Subsoil soluble (kg/ha)	**Subsoil reservoir** (kg/ha)
SO_4 0.8	**SO_4** 2528.1
Mg 0.5	**Mg** 90.9
Ca 0.6	**Ca** 481.9

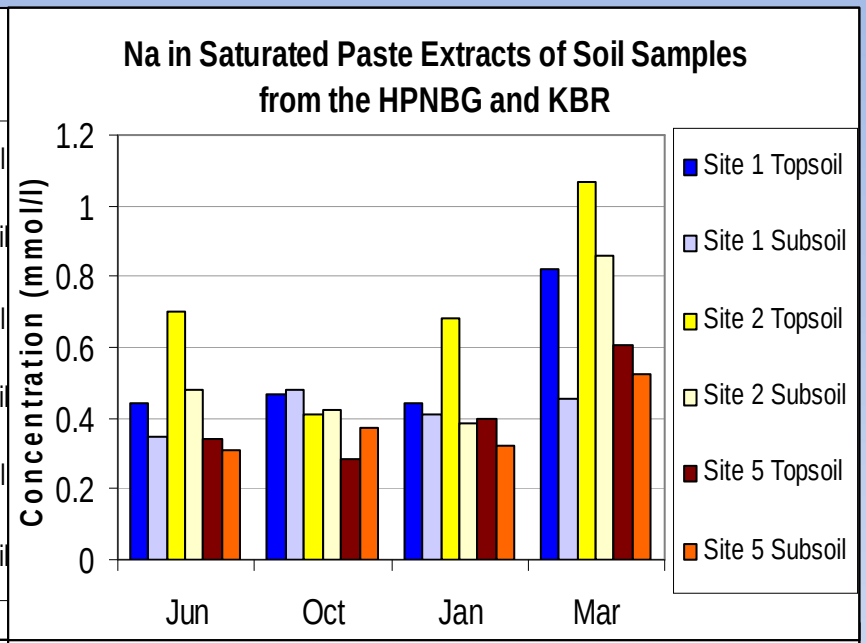
Effects of Fire on a Fynbos Ecosystem

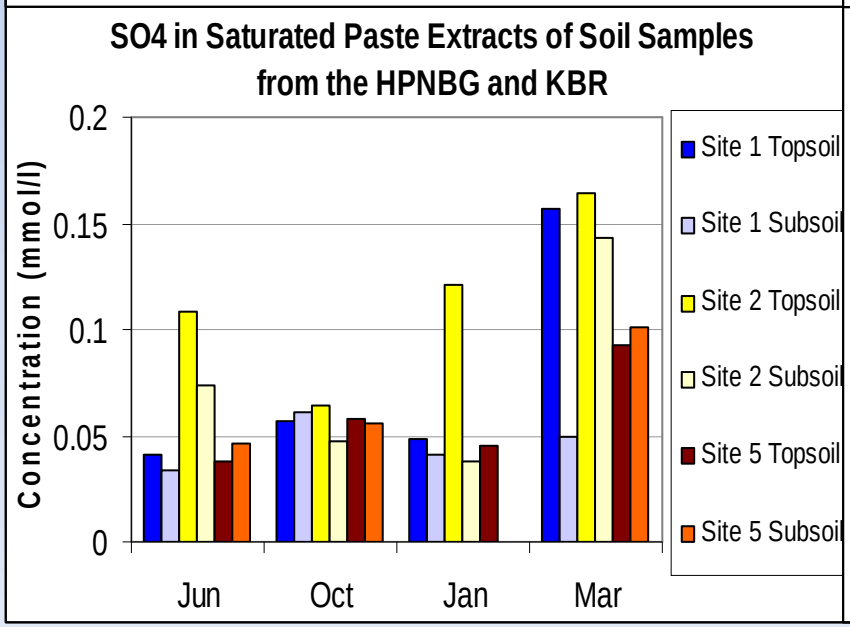
- Fire is a natural occurrence in the fynbos biome.
- Above-ground plant biomass affected.
- Hydrological effects (Scott and van Wyk, 1992; Scott, 1993; DeBano, 2000; Pérez-Cabello, 2009) .
- Nutrients are released, volatise or may concentrate in specific areas.

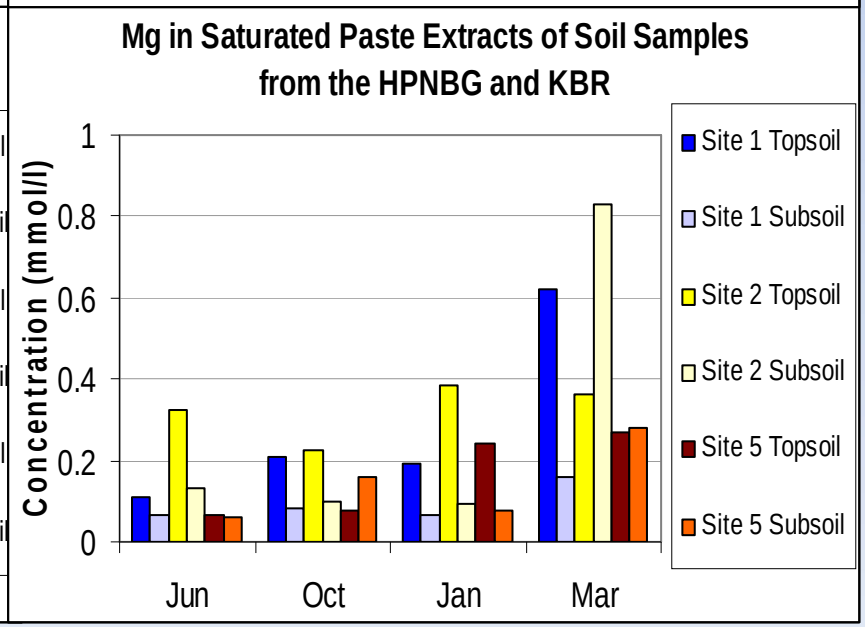
UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

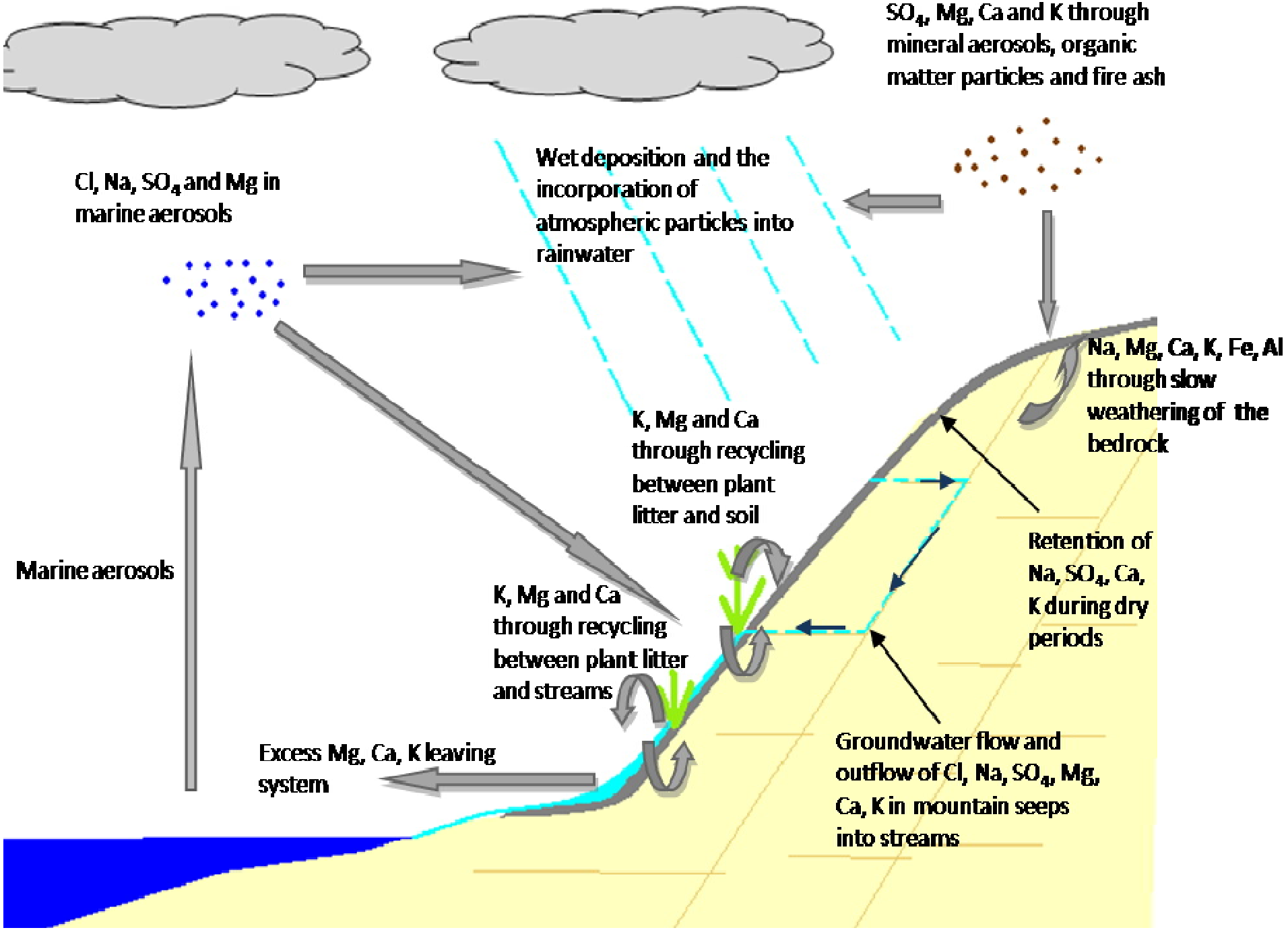
Salts accumulate in soils during dry periods










SO_4, Mg, Ca and K through mineral aerosols, organic matter particles and fire ash
Cl, Na, SO_4 and Mg in marine aerosols
Wet deposition and the incorporation of atmospheric particles into rainwater
Na, Mg, Ca, K, Fe, Al through slow weathering of the bedrock
K, Mg and Ca through recycling between plant litter and soil
Marine aerosols
Retention of Na, SO_4, Ca, K during dry periods
K, Mg and Ca through recycling between plant litter and streams
Excess Mg, Ca, K leaving system
Groundwater flow and outflow of Cl, Na, SO_4, Mg, Ca, K in mountain seeps into streams

Conclusions

- Marine aerosols are delivered from the south; mineral aerosols from the interior.
- Fires may volatize, redistribute or concentrate ions in soil.
- Net loss of K and net gain of SO_4, Mg and Ca post-fire.
- Hydrophobicity leads to a decrease in soil moisture.
- Retention of salts during dry summer conditions.


Thank you for
your attention