Geological influences on the biogeochemical properties of the soil and on selected aspects of the CNF forest communities
Important Soil Properties

• texture
• structure
• color
• clay mineralogy
• cation exchange capacity
• pH, base saturation
• Organic matter content/quality
• nutrient content (Base cations, N, P)
• Water holding capacity
• Mottling, aeration (redox potential)
• Secondary salt content (carbonates, etc.)
• Drainage Class (water table depth by month)
• Saturated Hydraulic conductivity
• Linear extensibility
• Erosion factors (for RUSLE)
Important Soil Properties

- texture
- structure
- color
- clay mineralogy
- cation exchange capacity
- pH, base saturation
- OM content/quality, C stabilization mechanisms
- nutrient content (base cations, available N, P)
- Water holding capacity
- Mottling, aeration (redox potential)
- Secondary salt content (carbonates, etc.)
- Drainage Class (water table depth by month)
- Saturated Hydraulic conductivity
- Linear extensibility
- Erosion factors (for RUSLE)
Fig. 1  Geology

Geologies
- ALTERATION TERRANE ?Tertiary and/through Cr
- SUBMARINE BASALT AND CHERT TERRANE
- VOLCANICLASTIC Cretaceous
- Quaternary Alluvium
- SUBMARINE BASALT AND CHERT TERRANE C
- Tithonian INTRUSIVE TERRANES Tertiary through Cre
- VOLCANICLASTIC Cretaceous

East Peak Climate Station
Fig. 2  Elevation
Fig. 3 Soil Great Groups
The name of a soil tells you a lot:

Aeric Haplaqualf

Aeric Hapl aqu alf

- Alfisol (Order)
- High water table (Aquic Suborder)
- Minimum set of horizons (Great Group)
- Not saturated long (Subgroup)
Luquillo Mountains,
Puerto Rico,
Quartz Diorite
Dystrudepts/Quartz diorite

Dystrudepts
Inceptisol (argillic horizon not strongly developed)
Moist in all months
exch. base cations/exch. Al is low
(this reflects the low Ca, Mg Content of the qtz diorite)

Eutrudepts/Basalt

Eutrudepts
Inceptisol (argillic horizon not strongly developed)
Moist in all months
exch. base cations/exch. Al is high
(this reflects the high Ca, Mg content of the basalt)
Humic Haplaquox

Typic Humaquepts

Luquillo Mountains, Puerto Rico (volcaniclastics)
Hapludox

Oxisol (oxic horizon = low CEC, Few or no weatherable minerals..)

Moist all months

No accessory horizons

High-elevation aquic soils

Hum aqu epts,
Hapl aqu ox’s

Upper horizons are Saturated much of The time
We can measure the properties of interest in the 4 groups.
……But only selected comparisons reflect the direct influence of lithology because elevation differences make climate and vegetation different as well.

Sampling soils on different lithologies where elevation, climate, and vegetation are the same will give the most useful information about the influences of lithology on ecosystem biogeochemical properties.
Fig. 5  Vegetation 1
Figure 6  Land cover (vegetation 2)
Sampling soils on different geologic units where elevation, vegetation and climate are the same can answer questions like:

“other things being (more or less) equal is there an influence of lithology on forest/soil biogeochemical properties?”
Influence of geology on biogeochemical properties of Colorado Forest/soils
Influence of geology on biogeochemical properties of Colorado Forest/soils
Influence of geology on biogeochemical properties of Tabonuco Forest/soils
Influence of geology on biogeochemical properties of Palm Forest/soils
15 sites x 6 sets of ridge, backslope, valley = 270 profiles
Quantitative Pits/cores (4 samples/profile)
Multivariate Regression

Fig. 6.
Soil and Geology

- **DYSTRUDEPTs Tkh-INTRUSIVE TERRANES**: Tertiary through Cretaceous quartz-diorite
- **EUTRUDEPTs SUBMARINE BASALT AND CHERT TERRANE**: Cretaceous
- **Hapludox Volcaniclastics**
- **High Elevation Aquic Soils**