Comparing soil nutrients between an annual burned and patch burn grazing system

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Cattle Production and Management

Cattle production has an incredibly detrimental impact on the surrounding wildlife. Management of cattle often *diametrically opposes* health of an environment. It is increasingly difficult to justify environmental concerns to a cattle rancher against forage for their herds.

Annual Burning and Grazing (ABG)

ABG is commonly used by management to stimulate growth of vegetation in grazed areas. While this technique does *increase forage production*, it comes ***at the cost of habitat quality***. To move away from this management strategy, PBG has been created.

Patch Burn Grazing (PBG)

This new burning strategy is much more localized, while still instigating growth from vegetation. This **hybrid practice allows for a mixing of values, both of conservation and business practicality**. It has been described as a *"shifting mosaic"* of vegetation, supporting environmental heterogeneity and stability. This practice is just as effective in producing forage as ABG is, with more environmental consideration.

Soil Nutrients and Fire

Evidence of the pros of PBG still needs to be provided for multiple biota, as well as effects on *soil quality*. Resin bags were placed across the landscape to discover how *ABG* and *PBG* alternatively affect soil nutrient levels of: nitrate (NO3), ammonium (NH4) and phosphorous (P). Standard HCl and KCl extraction was used for P and NO3/NH4, respectively.

```
#Bind N and P together
Soil21<-rbind(N21, P21)
Samplesoil21<- Soil21 %>%
  filter(str_detect(sample, "^U")) %>%
  group_by(sample) %>%
  summarise(max = max(concentration, na.rm=TRUE)) %>%
  ungroup()
```

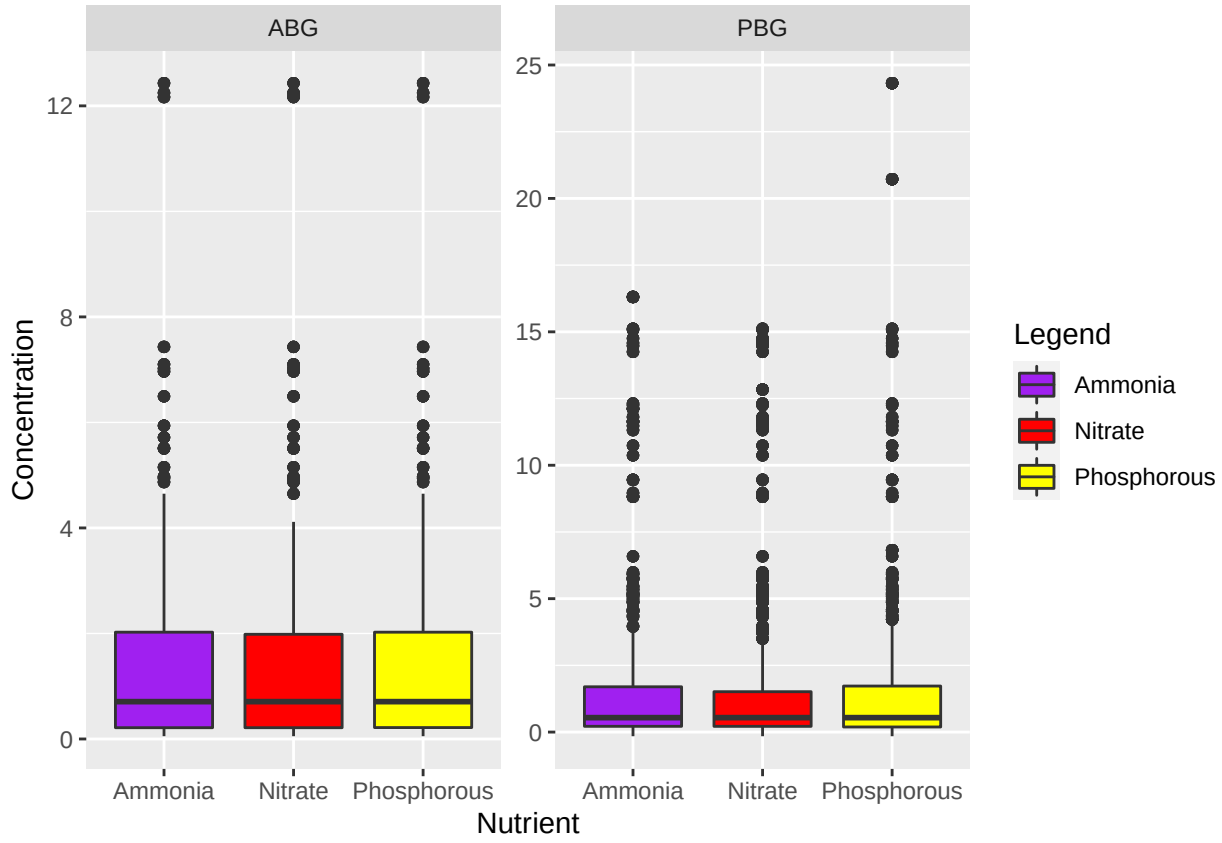
```
#Bind N+P to treatment
SSS<-Soil21 %>%
  select(concentration, units, test, Sample, sample) %>%
```

```
  filter(na.rm=TRUE)%>%
  filter(str_detect(sample, "^U"))

big21<-left_join(SSS,Samplesoil21)
```

```
## Joining with `by = join_by(sample)`
```

```
big21[c('watershed','transect', 'plot', 'misc')]<-str_split_fixed(big21$Sample, '-', 4)
T21<-big21%>%
  select(max, concentration, sample, units, test, watershed)


STSoil21<-full_join(transect21, T21, by=c("watershed"), na.rm)
```

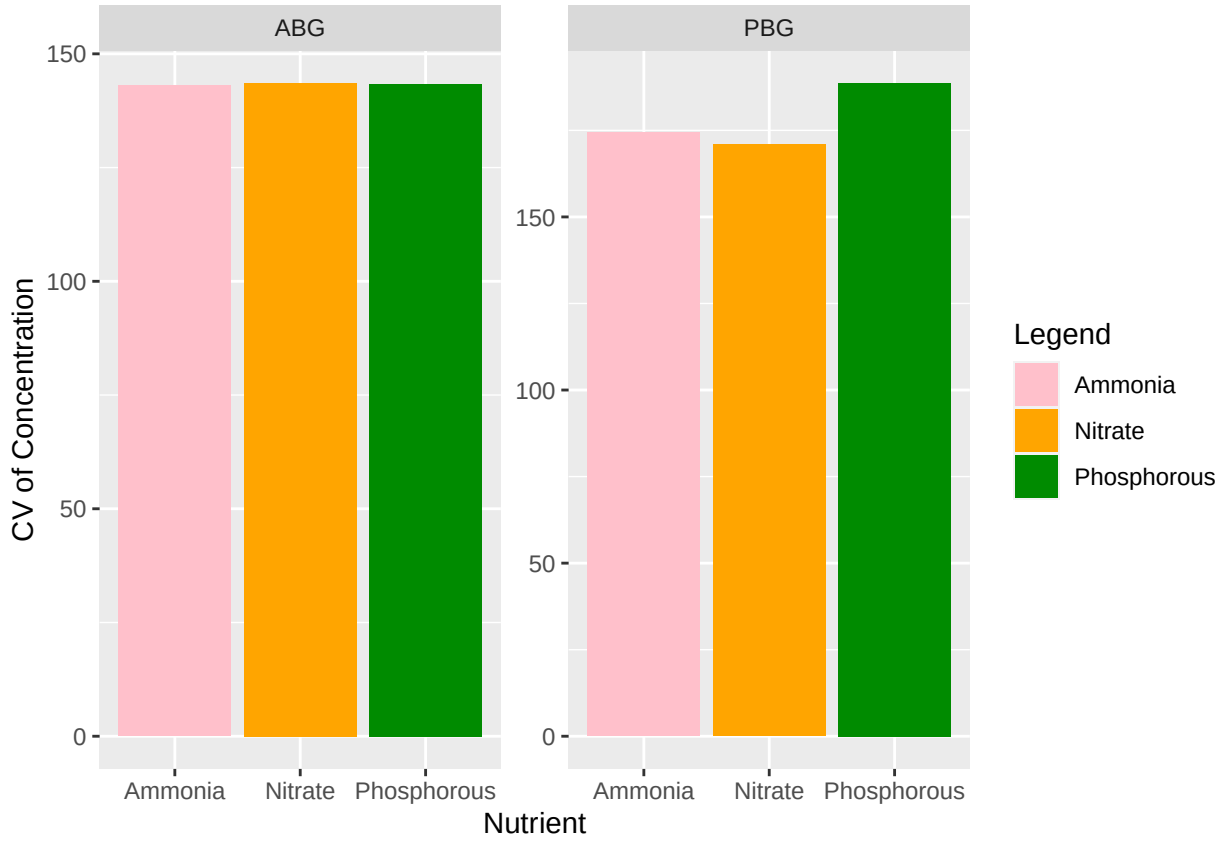
```
treat<-unique(STSoil21$test)


uniquename <- STSoil21 %>% mutate(test = ifelse(test %in% c("HCl PO4_1","KCl Ammonia 10","KCL NO3_NO2 2



#Boxplot of concentration by treatment, colored by treatment and data
ggplot(uniquename, aes(x = test, y= as.numeric(concentration), fill = as.factor(test))) +
  geom_boxplot() +
  facet_wrap(~treatment, scales = "free") +
  scale_fill_manual(values = c("purple","red", "yellow")) +
  xlab("Nutrient") + ylab("Concentration") +
  labs(fill = "Legend")
```




```
cv <- function(x) 100*( sd(x, na.rm = TRUE)/mean(x, na.rm = TRUE))

cvframe <- uniquename %>%
  group_by(treatment, test) %>%
  summarize(cv = cv(as.numeric(concentration))) %>%
  ungroup()
```

```
## `summarise()` has grouped output by 'treatment'. You can override using the
## `.groups` argument.
```

```
ggplot(cvframe, aes(x=test, y= as.numeric(cv), fill = as.factor(test))) +
  geom_bar(stat = "identity") +
  facet_wrap(~treatment, scales = "free") +
  scale_fill_manual(values = c("pink","orange", "green4")) +
  xlab("Nutrient") + ylab("CV of Concentration") +
  labs(fill = "Legend")
```



ABG vs PBG

ABG *increases forage production*, it comes ***at the cost of habitat quality***. PBG is much more localized, while still instigating growth from vegetation. This **hybrid practice allows for a mixing of values, both of conservation and business practicality**. It has been described as a *"shifting mosaic"* of vegetation, supporting environmental heterogeneity and stability.

Under these considerations, with provided data, it can be said that PBG leads to less abundantly available nutrients with a lower degree of variability. To me, this seems to be taking the landscape simultaneously through multiple succession timelines all at once. Lower nutrient availability allows for slower-growing species to compete with fast growing gasses and forbs, who will likely take over the ABG plots, due to higher nutrient availability.