Understanding Farmer-Herder Conflict Between the Mossi and Fulani in Burkina Faso, Africa using Agent-based Modeling (ABM)

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Abstract

In 1970, the AVV began relocating Fulani pastoralists to the southern region of Burkina Faso. While there was plenty of available grazing land at the time, this changed as populations grew and climate change worsened. This "saturation of space" led to high levels of conflict between the groups, a phenomenon modeled using NetLogo in this thesis. Analysis of the ABM showed that conflicts were directly linked to population growth and occurred as a result of the saturation of space in the region—not due to historical tensions, as many scholars have previously argued. It also reinforced the notion that these conflicts are not random, but rather occur in strategically important locations.

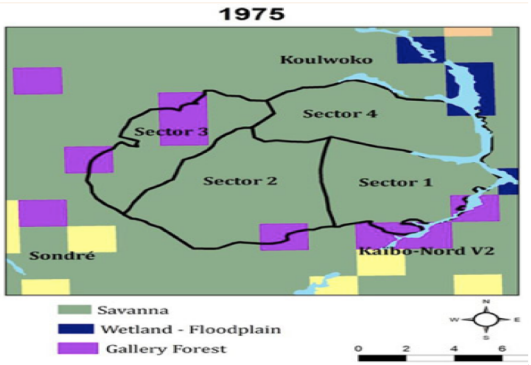


Figure 1. Lisa Nebie's map of the Sondre region in Burkina Faso in 1975, in the very beginning of voluntary relocation of pastoralists into the region.

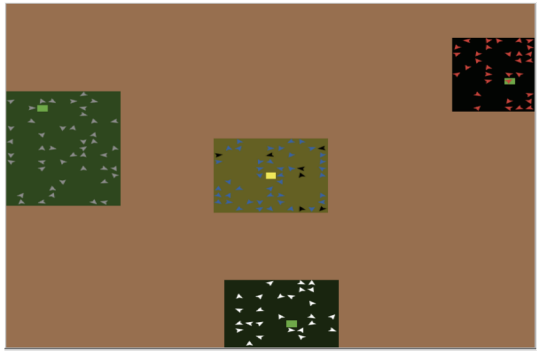


Figure 2. My model "world" in 1975. Based off of Nebie's map above, where the brown represents unused land, the shades of green represent agricultural land and the yellow represents grazing land.

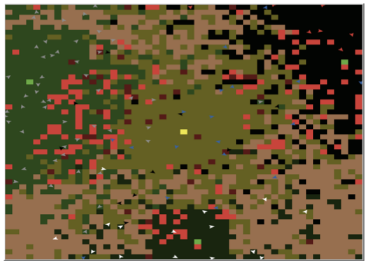
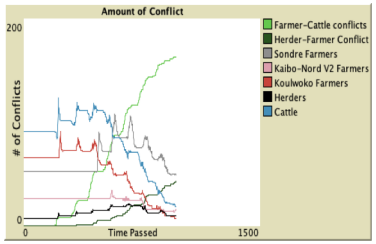


Figure 3 + 4. As the plotter shows, as populations reach a certain threshold, conflict becomes unavoidable—increasing nearly exponentially. However, when populations are stable, so are the levels of conflict. Due to their large grazing area, cattle are the most frequent source of conflict.

The image on the left shows my model mid-run, while the image on the right shows a plotter tracking each population's size and the levels of conflict.




```
ask farmers3 [
  if any? cattle-here [
    if (pcolor = green - 5)[
    let target one-of cattle-here
    ask target [die]
    set pcolor red
] ] ]
ask herders [
  if any? farmers1-here [ ;;if there are farmers trying to establish fields on pastoralist land...
    if (pcolor = yellow - 3)[
    let target one-of farmers1-here ;;conflict occurs
    ask target [die]
    set pcolor red - 3
]]]
```

Figure 4. This is a snippet of the code from my react procedure. It is responsible for governing conflict in the model. It highlights two forms of conflict: farmer-cattle and herder-farmer. Farmer-cattle conflict occurs when farmers find cattle grazing on their land, while herder-farmer conflict occurs when a herder finds a farmer attempting to establish agricultural land on their perceived grazing land.

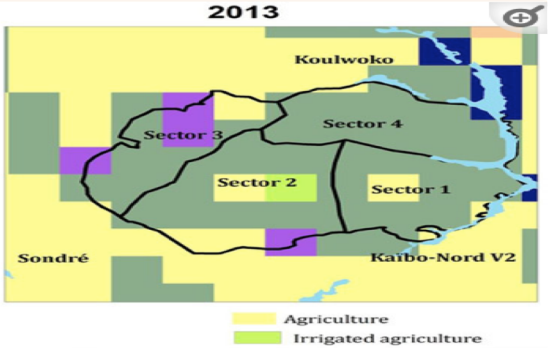
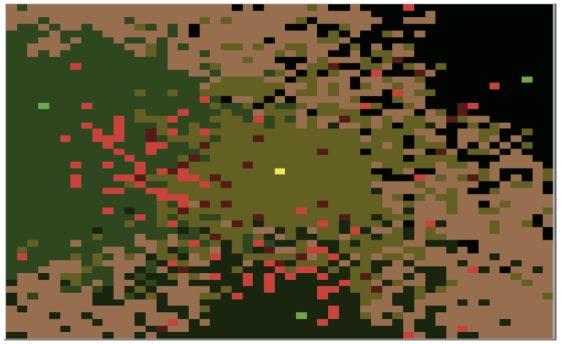


Figure 5 + 6. These images represent Nebie's final map and my final map, respectively. Clearly, agriculture has expanded rapidly due to population growth, leading to conflict between the Mossi and Fulani. In my model, the bright red represents farmer-cattle conflict while the dark red is herder-farmer conflict.



Conclusions – 4 Main Takeaways

1. There is a strong direct relationship between population growth and conflict frequency in the region
2. Points towards a threshold, where if populations simultaneously peak, significant levels of conflict are unavoidable in the current conditions
3. The model reinforces Breuser et. al's claim that farmers and herders in Burkina Faso have historically had a symbiotic relationship and that it is specifically increasing populations and the saturation of space in the region that is driving these contemporary conflicts
4. Provides evidence for Nebié's claim that conflicts occur most frequently along the disputed borders between Sondré-Est and the surrounding Mossi villages

Limitations and Potential Future Expansions

1. Limited to a small geographic region in Burkina Faso, but can be modified and placed into another environment that is experiencing farmer-herder conflicts
2. Climate change could be added as an additional contributing factor to field expansion
3. Cooperation or agropastoralism, both brought to the forefront by Mark Breusers, could be implemented as "scenarios" within the model to evaluate their effects on the frequency of conflicts
4. The environment could become more detailed and include water, a key driver of conflicts in the region according to Nebié