

# Reducing deforestation and emission from fuelwood use with Improved Cook Stoves in selected communities in Oti and Volta regions of Ghana

"Climate change and governance: General trends and African countries"

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# Outline

- Background
- Introduction of Climate Smart Stoves (CSS)
- Mission Objectives
- Scope of the Study
- Data Collection Procedure
- Key Findings
- Conclusion and Recommendations
- Reference

# Background

- The Volta River in Ghana is dammed at Akosombo for hydroelectric power generation.
- Communities along the Volta Lake however heavily relied on trees along the lake for fuelwood, which was used for cooking activities in Traditional Three Stone Stoves (T3SS).
- The reduced tree cover resulted in high evapotranspiration and reduced water levels for electricity generation.



# Background



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- The threat posed by the reduced volume of water for hydropower generation has been exacerbated by climate change and deforestation.





# Background

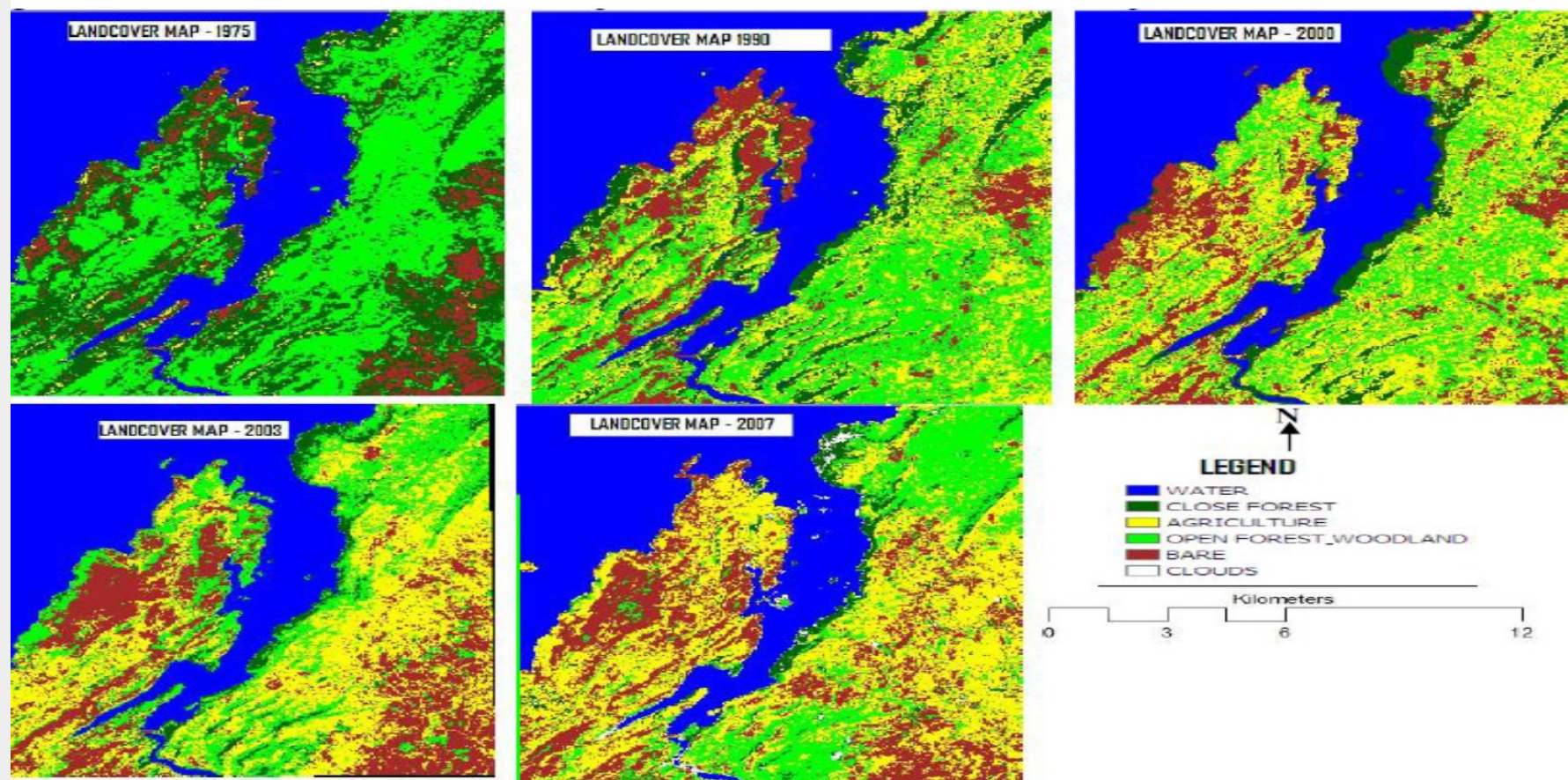
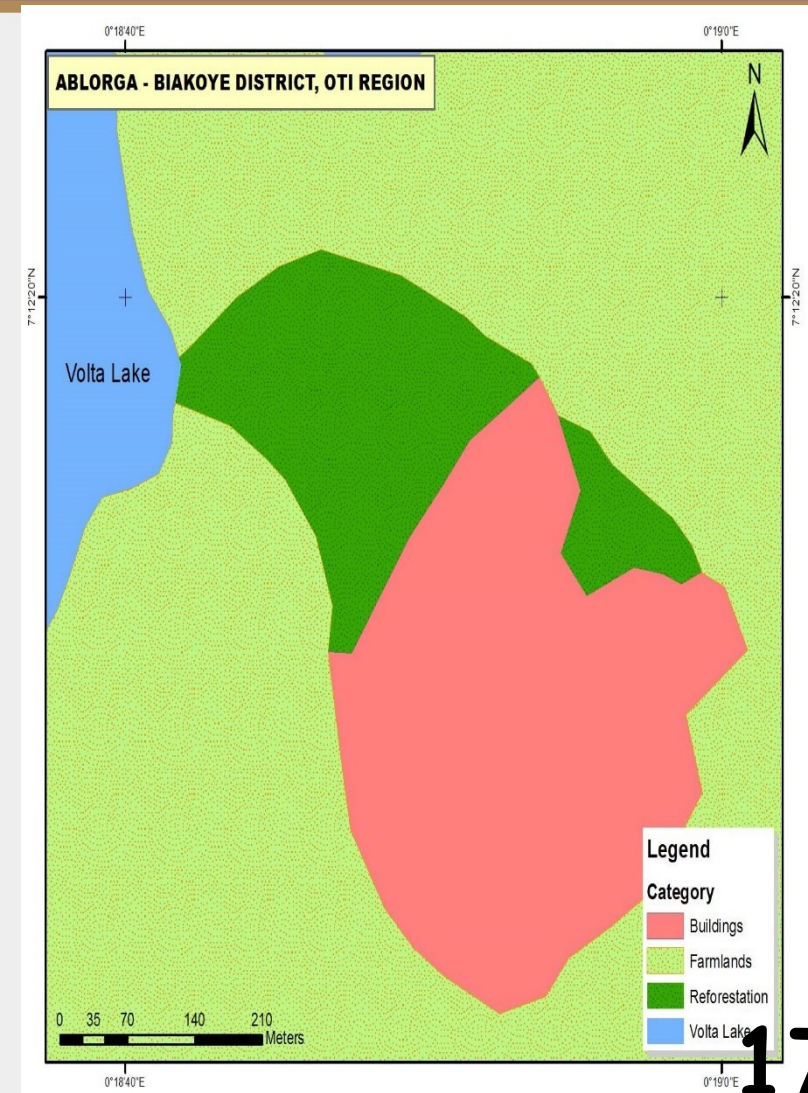
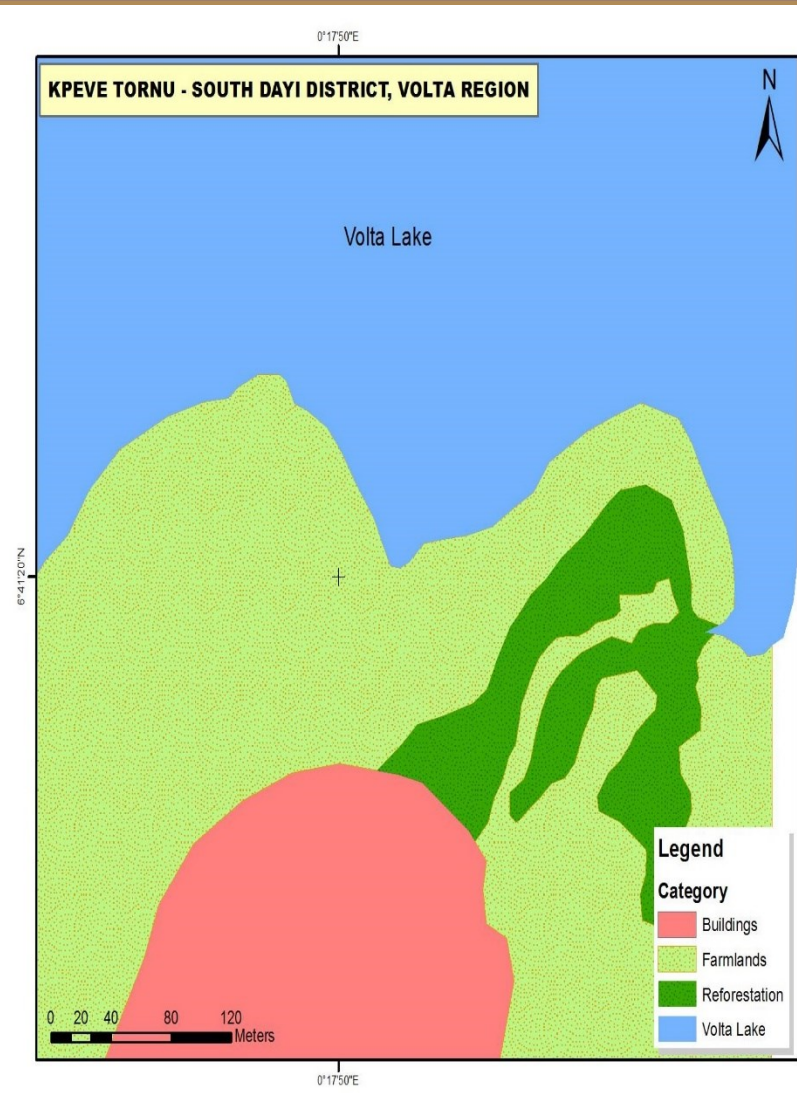
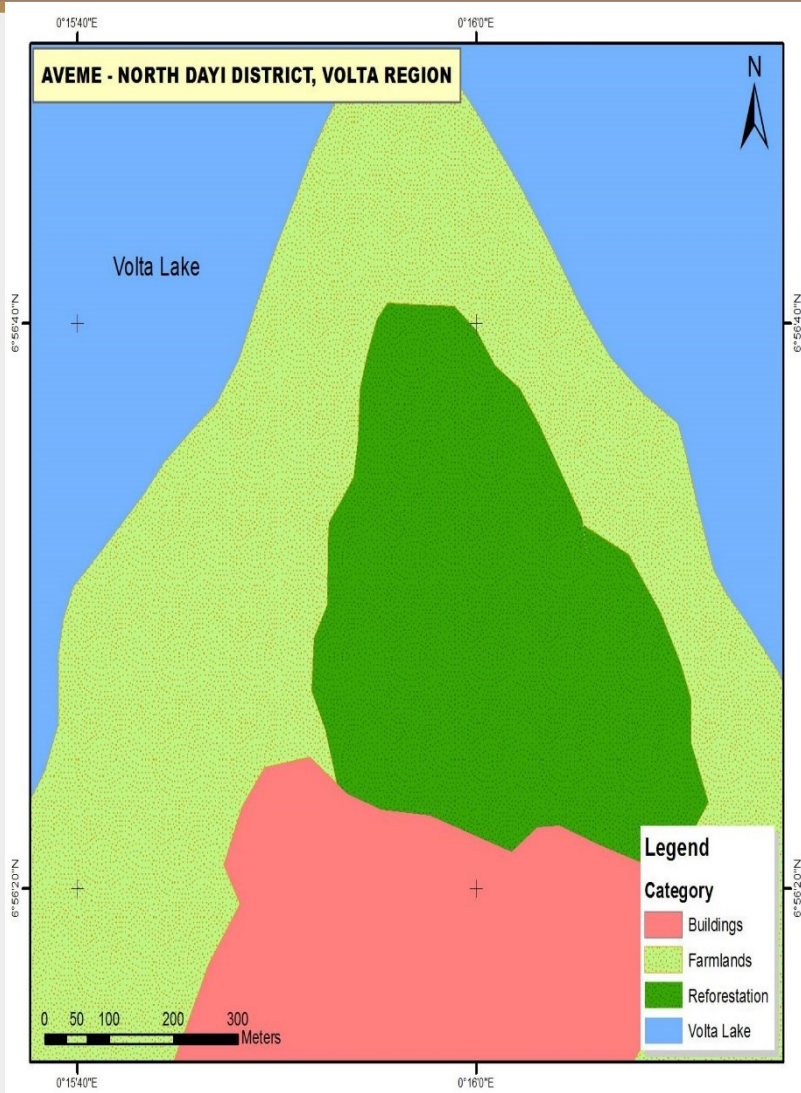


Figure 1: Land Cover maps of the Volta Gorge (Source: Land Cover change patterns in the Volta Gorge, Ampofo et al [2015])





# Base Maps of Reforested Areas



# Background

- Improved Cook Stoves (ICS), which were believed to consume less fuelwood, was introduced but its adoption was low.
- This study sought to ascertain the extent to which the ICSs have reduced fuelwood consumption and lowered emission of Carbon Monoxide (CO) and Particulate Matter (PM<sub>2.5</sub>).

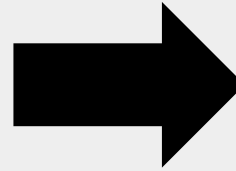




# Introduction of ICS



ICS



T3SS



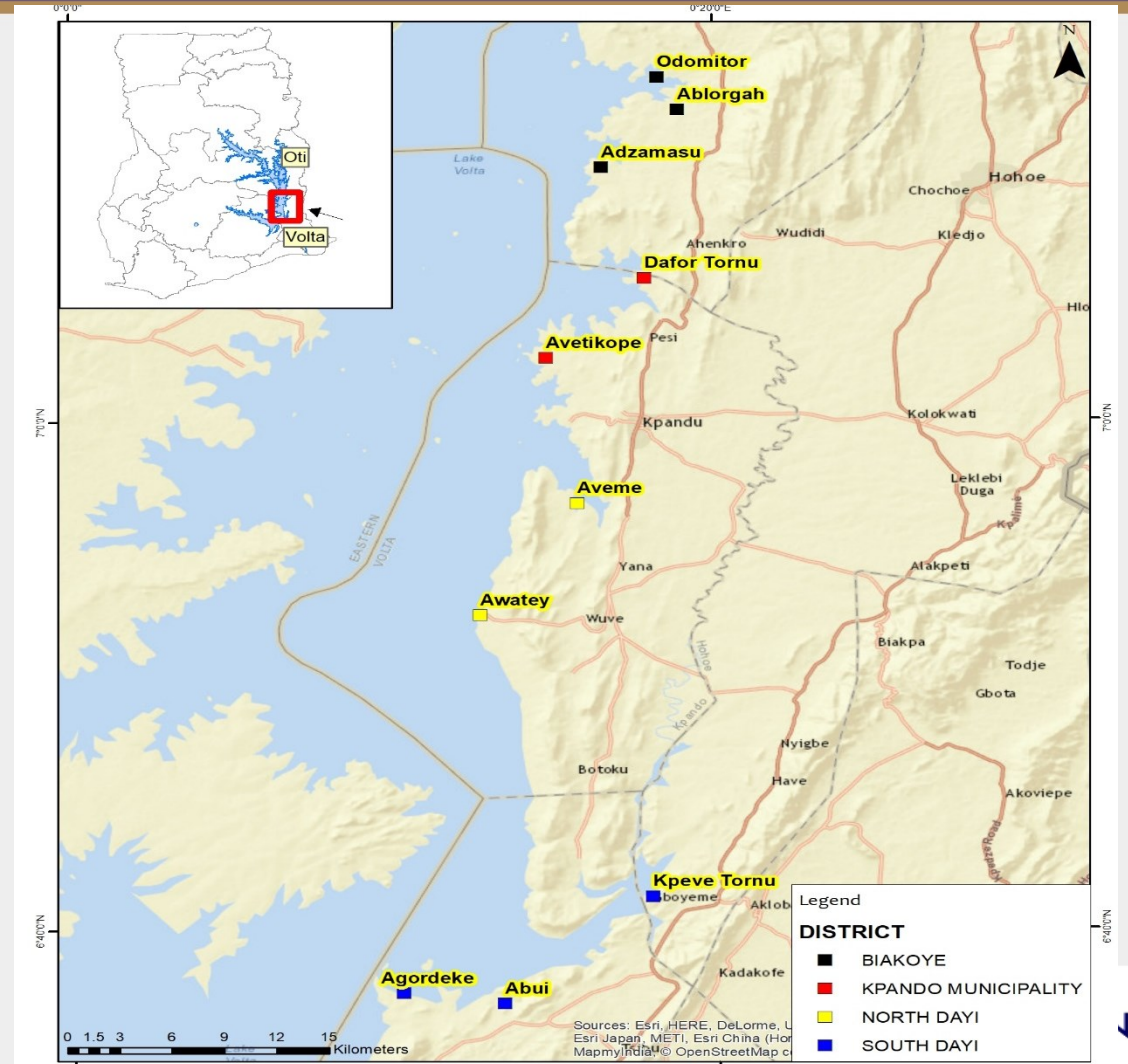
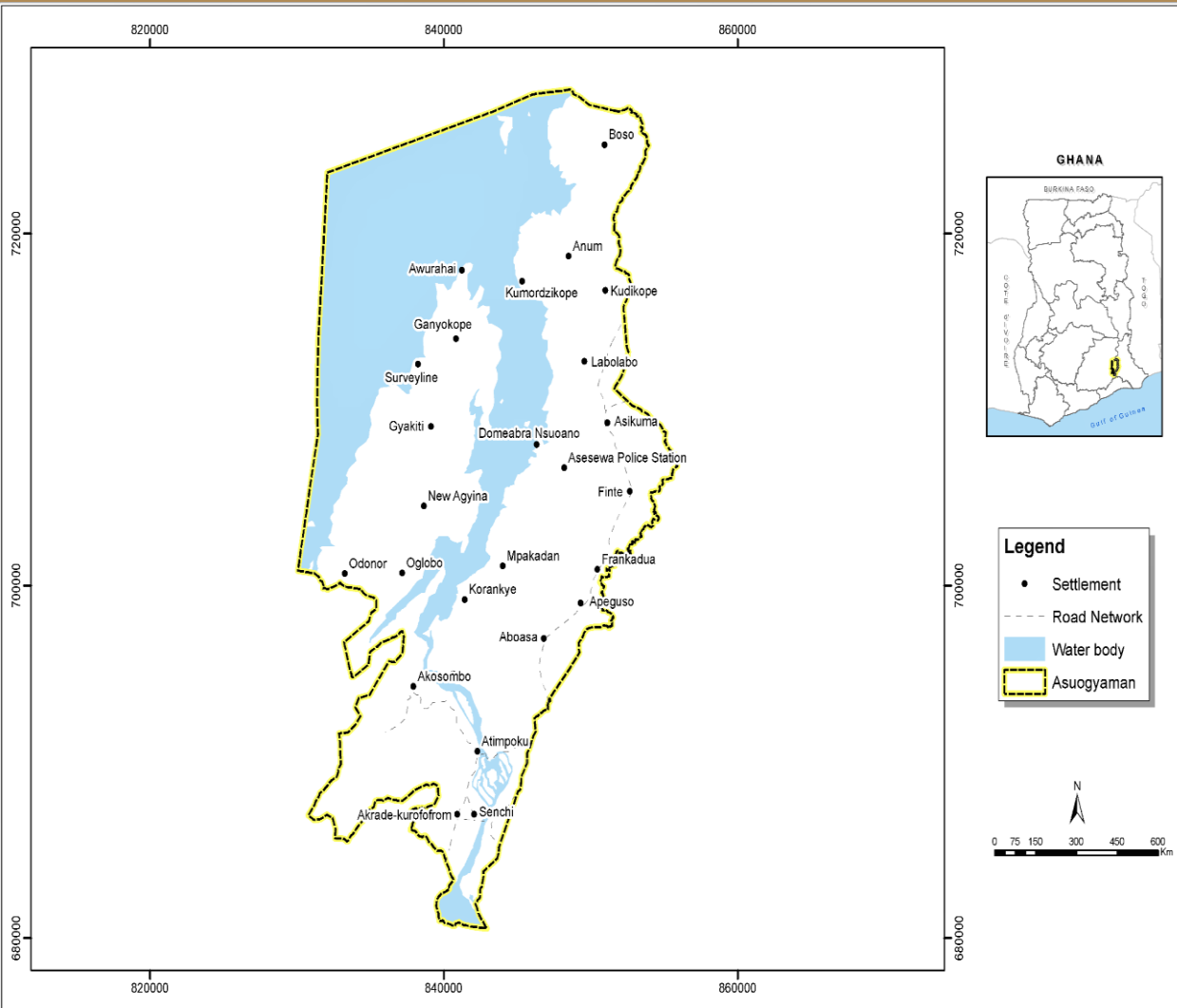
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# Mission Objectives

- Compare the amount of Carbon Monoxide (CO), Particulate Matter (PM<sub>2.5</sub>) and Sulphur Dioxide (SO<sub>2</sub>) produced by ICS and T3SS and its implication on health.
- Compare specific fuelwood consumption per meal cooked and total time spent in cooking meals between ICS and T3SS.
- Examine the major factors contributing to deforestation along the Volta Lake.
- Assess the trend in respiratory tract infections reported at health facilities along the Volta lake.
- Assess socio-economic factors that influence ICS adoption.
- Assess the perception of people on ICS as an innovation that improves health and environmental stability.



# Scope of the Study





# Data Collection Procedure

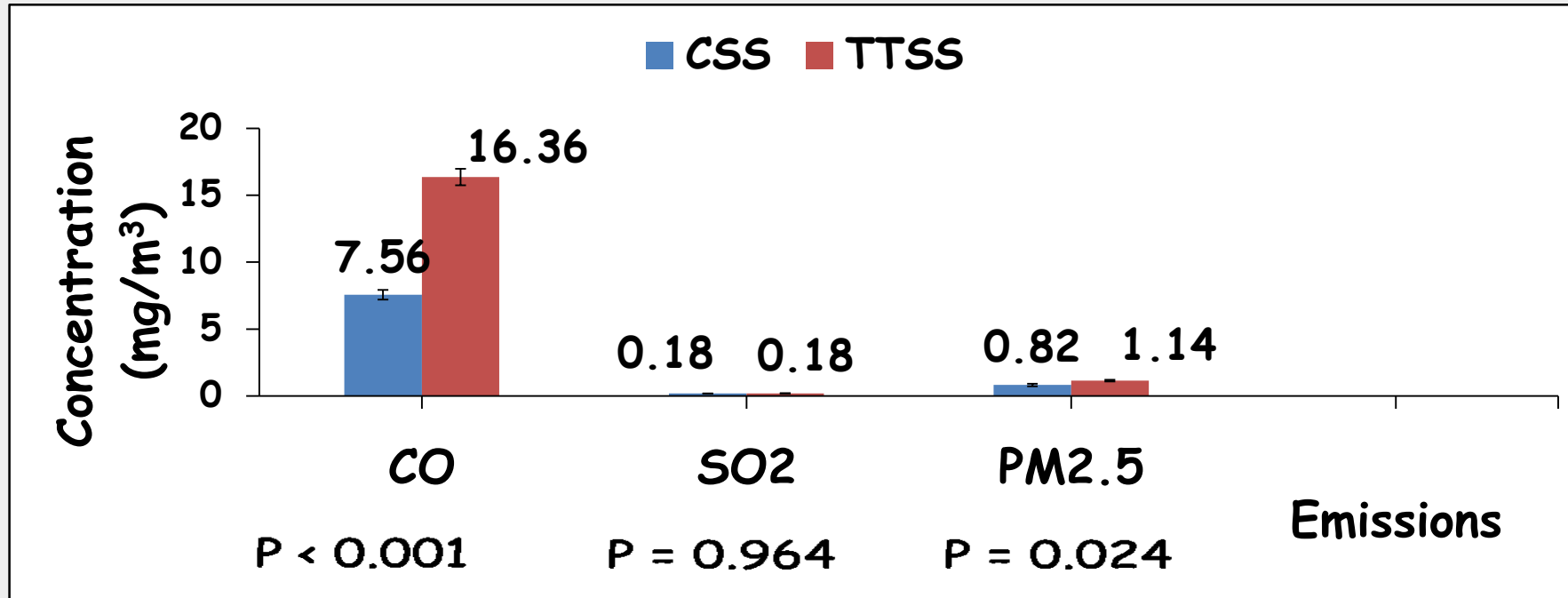




# Key Findings



# Comparison of CO, PM<sub>2.5</sub> & SO<sub>2</sub> produced by ICS & T3SS



- Chi-square test indicates 0% likelihood of having health issues when using ICS while 87% likelihood of having health issues when using T3SS.





# Respiratory Tract Infections

Age	< 1 Year	1 - 4	5-9	10-14	15- 17	18-19	20-34	35-49	50-59	60- 69	70 and Above	Total
Male	7681	<b>25850</b>	10450	6103	4110	1928	7029	5801	3391	2700	2954	77997 (41.38)
Female	6571	<b>23183</b>	11463	7149	5288	3295	<b>17073</b>	14947	9063	5665	6615	110312 (58.62)
Total	14252	49033	21913	13252	9398	5223	24102	20748	12454	8365	9569	188309

Source: Asuogyaman District Health Directorate and Volta River Authority Hospital



# Comparison of Specific Fuelwood Consumption Per Meal Cooked Between CSS & TTSS

- Comparison of fuelwood consumption between ICS and T3SS indicated the T3SS consumed more ( $295.67 \pm 349.92$ ) fuelwood than ICS ( $245.87 \pm 179.84$ ) but not statistically significant ( $p > 0.05$ ).
- The ICS saved 0.05kg of fuelwood in the preparation of 2.604kg of "Banku" (this amounts to 54.75kg fuelwood per household per year).
- Though fuel wood saving of ICS was not statistically significant, a higher adoption and usage of ICS will actually reduce fuel consumption if ICS are adopted on a on large-scale.

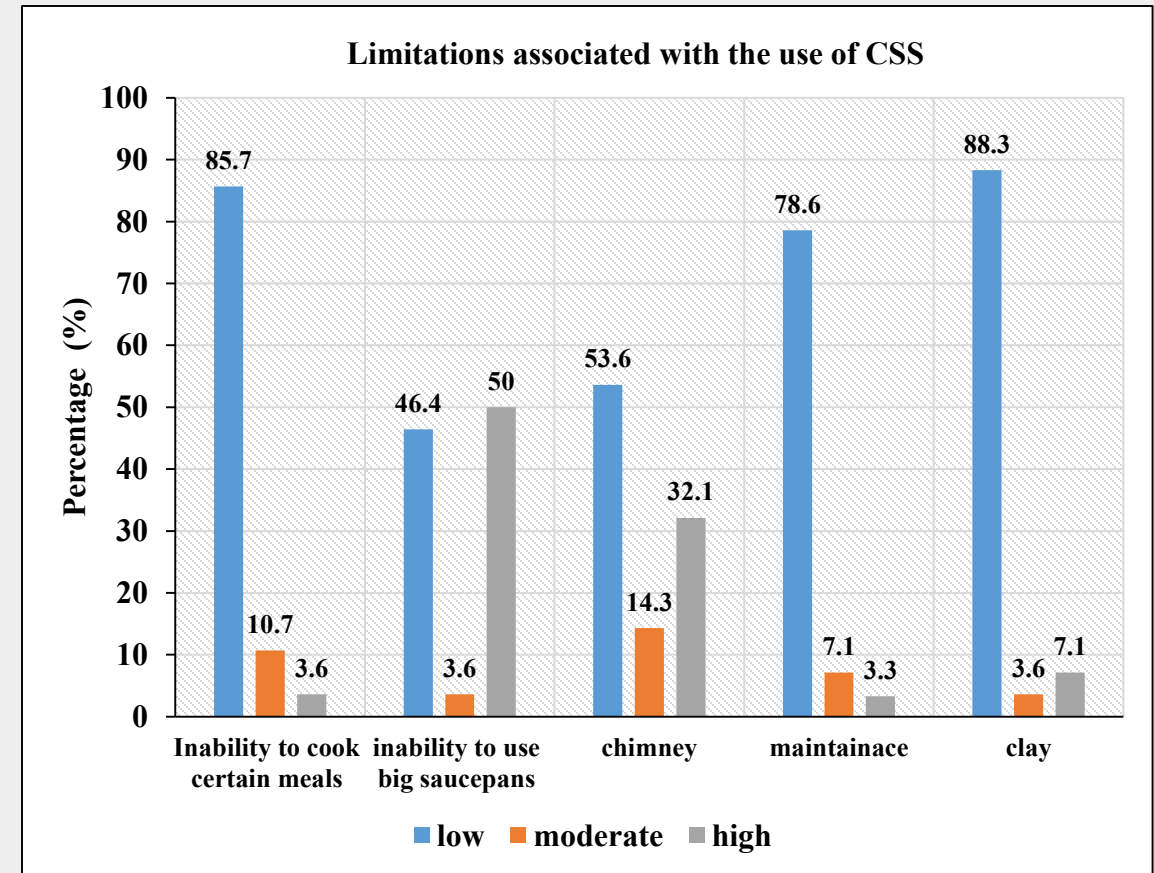
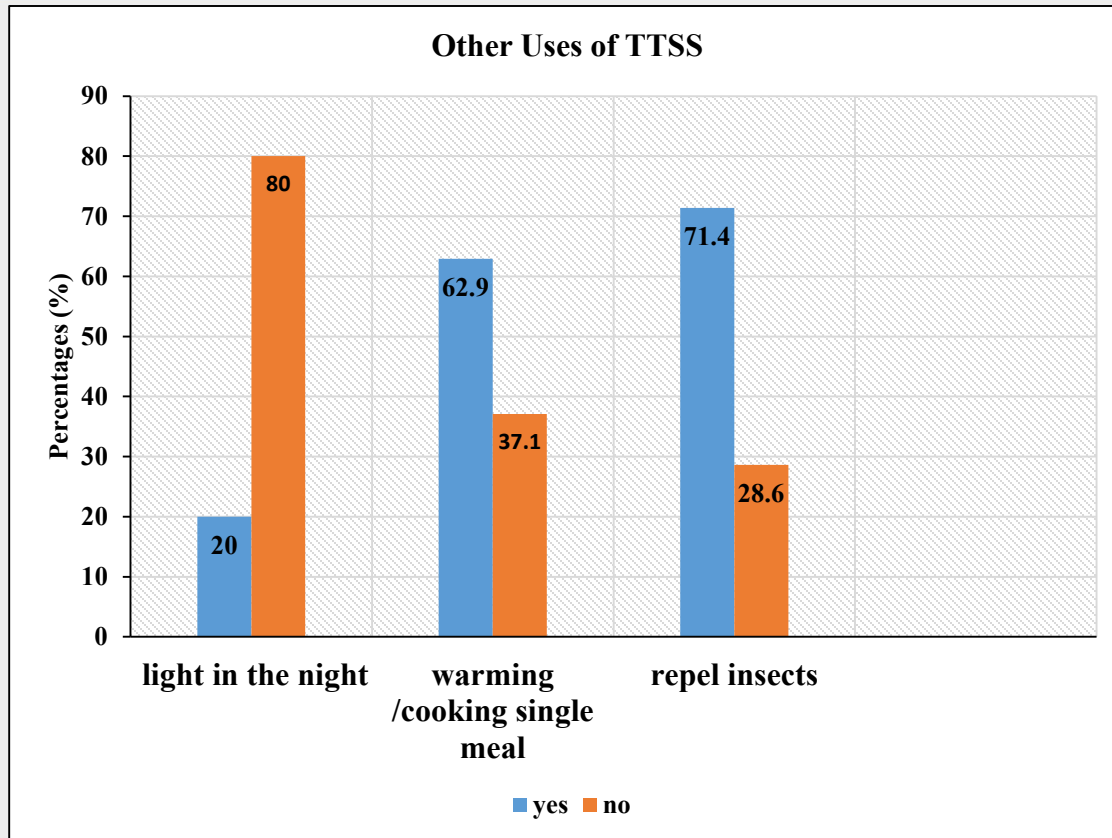


# Comparison of Total Time Spent in Cooking With CSS & TTSS

Type of Stove	N	Mean	SD	SE Mean
ICS	10	37.30	13.91	2.54
T3SS	10	20.93	5.42	0.99
Total	20	58.23	19.33	3.53



# Factors that Limit the Adoption & Use of ICS



**Cost** (50 to 450 Cedis) "I cannot pay anything more than 30 cedis, this is even too much for a stove".



# Reactions from FGD

- *“VRA did not tell us they were coming to build stoves for us. The clay must be kneaded and left for a minimum of 3 days to increase its malleability. We suffered with the stoves because they cracked and we had to reconstruct it. It was very time consuming. Those who could not repair theirs abandoned them”.*
- *“The education and monitoring should be frequent and should be done by women”. VRA should also try to get people who can speak our language ‘Ewe’; sometimes the translation is not clear. The language is very important.”*
- *“The clay in this community is not malleable, causing all the stoves cracked within a short period.*

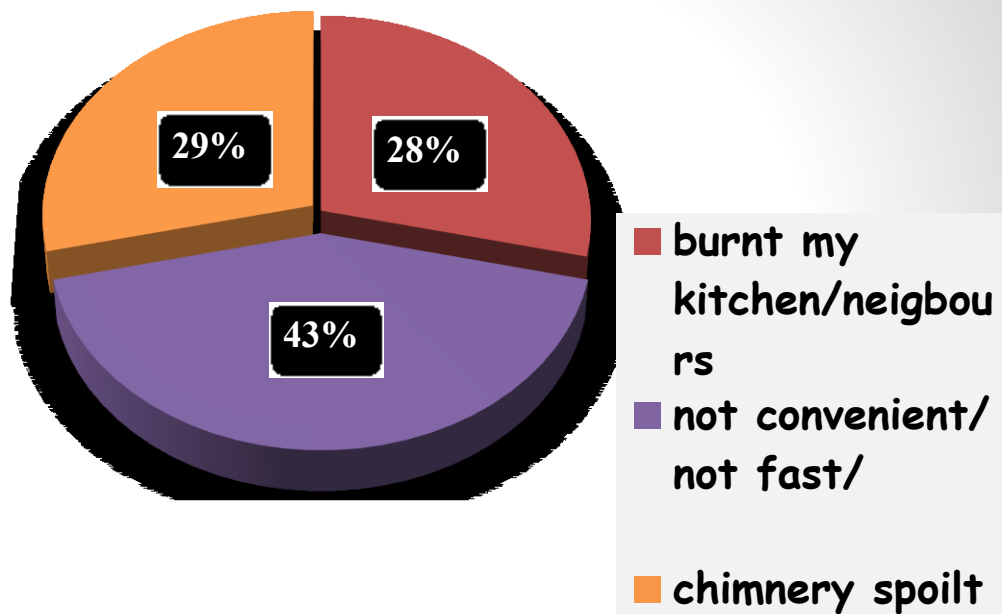


# Abandoned ICS

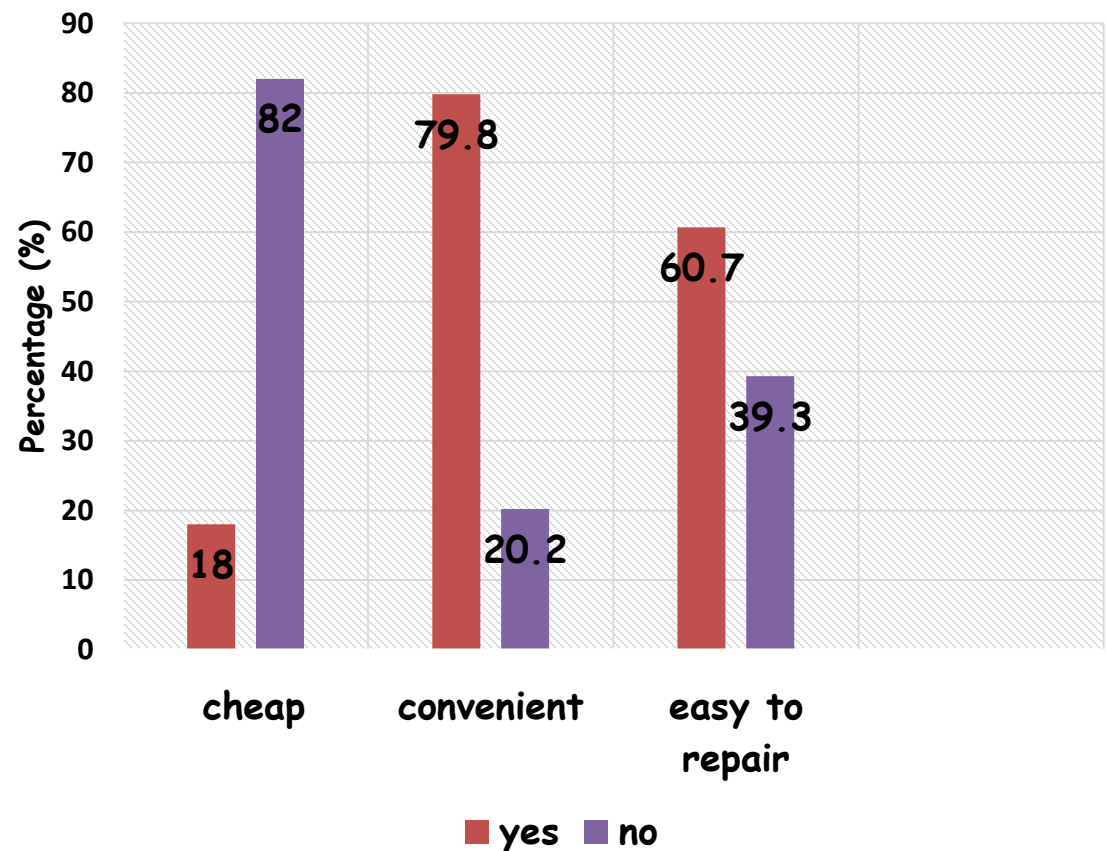




# Reasons Why ICS Was Abandoned/ Reasons For Preferring T3SS

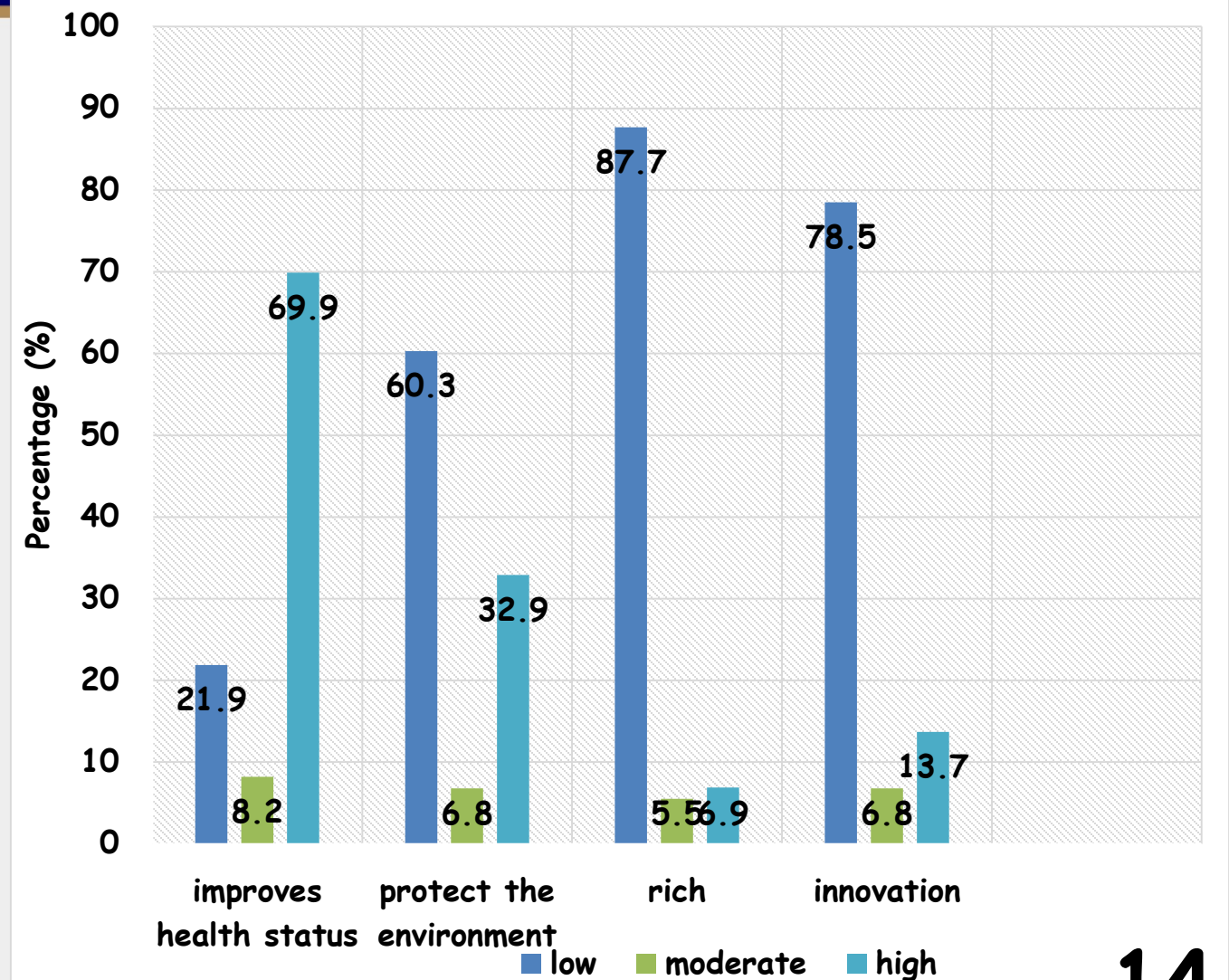


## Reasons for preferring T3SS



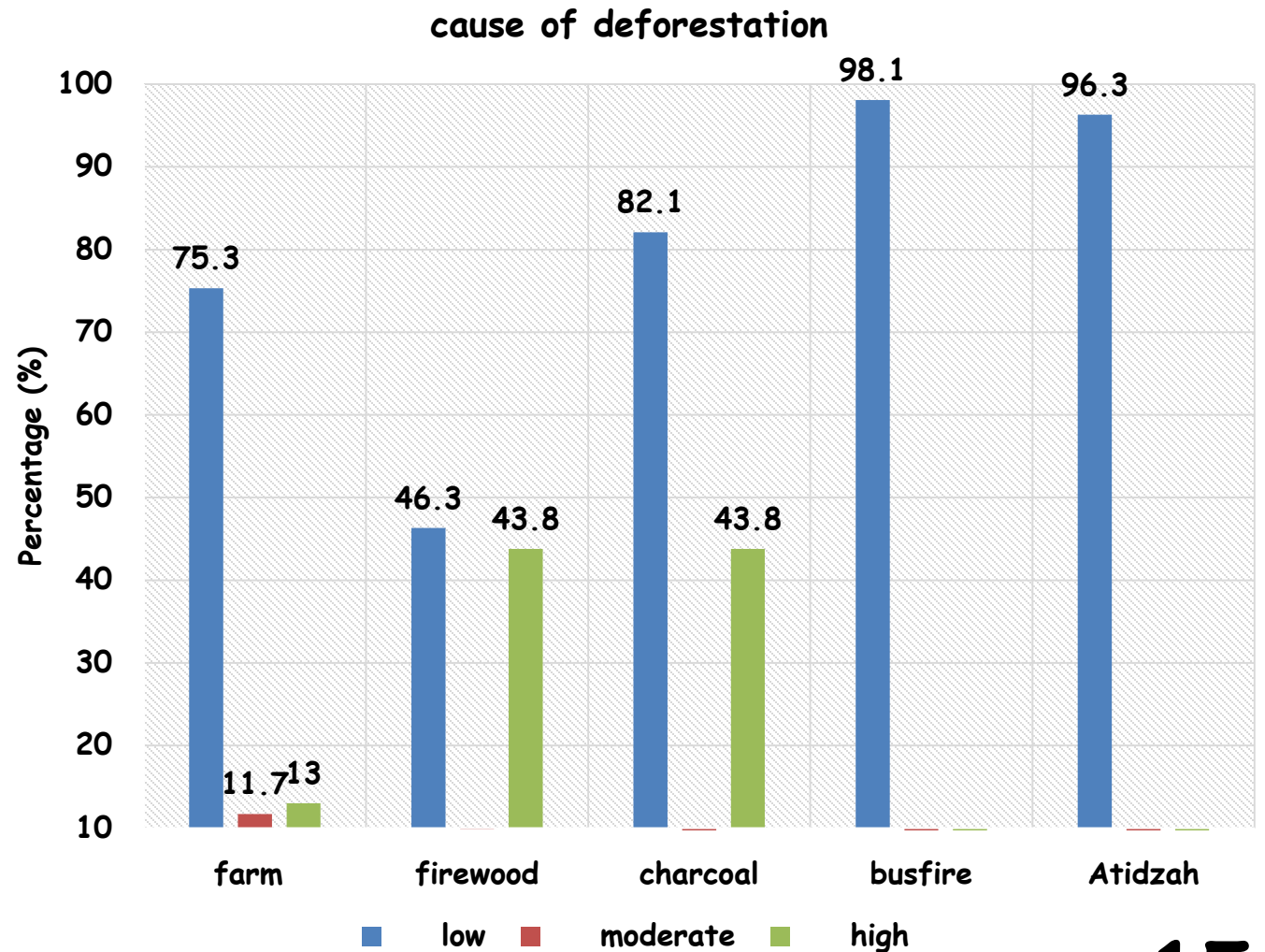
# Perception About ICS As An Innovation that Affects Health & Environment

- Users of ICS generally perceived the ICS as an innovation that improves good health, protect the environment.
- Most 74% T3SS users in the study areas perceived ICS as a “foreign” innovation that is not able to fully address their cooking practices.



# Major Causes of Deforestation

- Firewood gathering & charcoal burning.
- However, source of wood for these activities come from the farm, hence it is not clear as to whether people cut down solely to make charcoal, firewood or to farm.





# Conclusion

- The ICS significantly reduced CO and PM<sub>2.5</sub> in Asuogyaman, Oti & Volta
- in Oti & Volta ICS will save 54.75kg in 365 days but not significant due to small sample size
- Forest degradation is evident along the Volta Lake.
- Respiratory tract infections is prevalent among members of riparian communities particularly in women and children.
- Socio-cultural factors such as age, cost, limitations in use of ICS and varied uses of T3SS hinder adoption and use of ICS.
- Technical flaws of the ICS noted were perforation and length of chimney and lack of materials for repair.
- Language used for education, infrequent monitoring of CSS and cracks are reasons for its abandonment.



# Success In Ablonga



# Reasons

- Value of ICS by trained stove makers
- Women leadership
- Further, they adjusted the stove design to suit their use in terms of size, height, pot area opening and building commercial ICS.





# Limitations

- Abandonment of ICS
- Methodological approach



# Recommendations

- Efforts should be made to supply all households along the Volta Lake with the ICS through incentives and education
- Re-engineering of ICS (material, Chimney (2m), venting, and cooking pot - fire distance) & harvest smoke
- Education of the inhabitants and woodlot establishment and other alternative livelihoods.
- Frequent monitoring and education (Ablonga as model). Agreed and separated for ICS molding days and education.
- Promote Commercial ICS more
- Revision of guidelines on stove adoption to include accessibility of materials for repairs of the ICS to ensure sustainable use.
- Use of CCT and WBP
- Scientific analysis on why Clay in Adzamasu, malleable- Standard Clay for ICS



# References

- Bailis, R. (2007). *Controlled Cooking Test (CCT), Version 2.0. Berkeley, California: University of California-Berkeley.*
- Council for Scientific and Industrial Research (2017). *Cookstove Performance Report.*
- Ghana Statistical Service (GSS). (2014). *Ghana Living Standards Survey 6 Report.*, Accra,
- International Energy Agency (IEA) (2014). *Energy Balance of Non-OECD Countries.* Paris: IEA.
- International Rivers, (2013). *Climate Change And Rivers* <https://www.internationalrivers.org/our-work> assessed 21/08/2018
- Urme, T., & Gyamfi, S. (2014). A review of improved Cookstove technologies and programs. *Renewable and Sustainable Energy Reviews*, 33, 625-635.
- Volta River Authority Report (2016). *Environmental Education and Public Awareness on Climate Smart Stoves (Fuel Efficient & Energy Saving Cook Stove).*
- VRA ( 2010 ). *Abridged Annual Report. 2008 Volta River Authority* [hypertext transfer protocol: //www.vra.com/Publications/Accounts/vra\\_annual\\_report2009.pdf](http://www.vra.com/Publications/Accounts/vra_annual_report2009.pdf)
- VRA (2018). *Ensuring green banks through local invention: The Climate Smart Stoves -* [www.vra.com](http://www.vra.com), assessed 2/9/2018





