Understanding how climate and vegetation interact to control water availability, which in turn impacts vegetation growth and distribution

"Accessing the impact of Forest cover change on Water Yield in the Middle Hills of Nepal through the CCW-WaSSI Model."

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Theoretical framework of the hybrid ecohydrological model

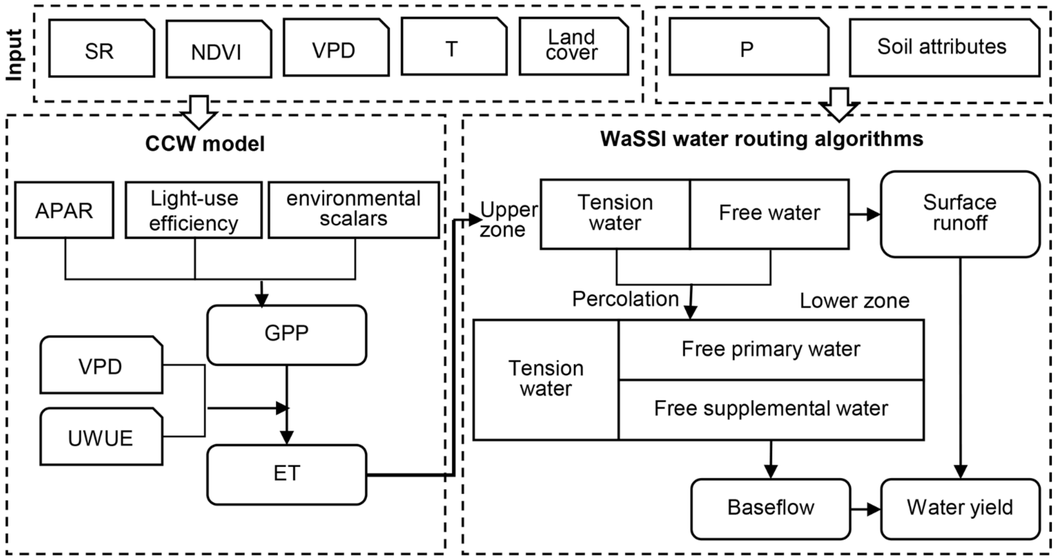
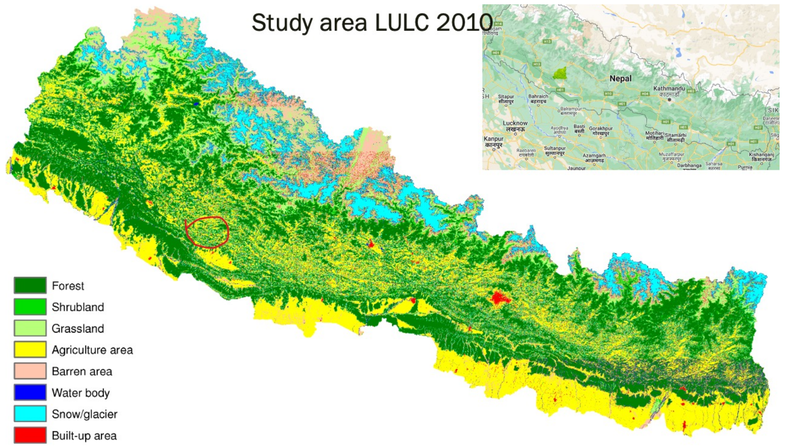


Figure 2. The framework of the CCW-WaSSI hybrid ecohydrology model. The corner-snipped rectangles denote inputs of the model, the rectangles denote state variables, and the rounded rectangles denote fluxes as model outputs. Arrows show the model process directions.

Q: How does forest cover change impact water yield in the middle hills of Nepal?

The goal of this research project is to use the CCW-WaSSI Model, an integrated ecohydrological model to conduct scenario simulations to study the effects of forest cover change in the middle hills of Nepal. This will be done by using remote sensing data from space that measure forest cover change through time along with meteorological data as input to CCW-WaSSI and hydrological data from gauging stations as validation. The objective is to provide references for water yield in the studied watersheds, and to evaluate the influence of Community Forestry on Socio-Environmental Systems in Nepal.



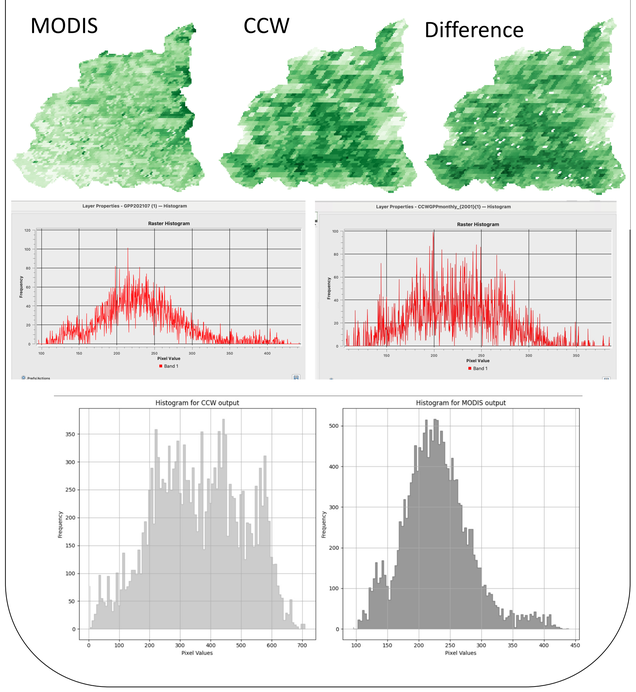
Why study community forestry?

- Mitigating climate change since forests play an extremely critical role in the earth ecosystem.
- To deal with alarming decreasing rate of deforestation, especially in South America and Africa, preserving the forests in those places in ways that benefits local communities and beyond.
- Those questions are not only unique to Nepal and providing answers to them would benefit the people on this planet greatly as we are of a community of shared future.

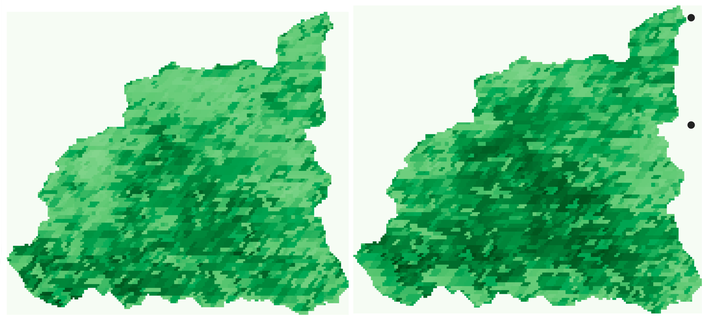
➢ Key Limitations from dataset

Climatically aided interpolation interpolates anomalies from the coarser resolution parent product to the higher-spatial resolution climatology. As such, sharp gradients in climate anomalies in montane or near coastal environments, will not be realized as Terra

➢ GPP Year 2021 comparison



➢ CCW GPP results year 2001, 2021



➢ Interpretation:

MODIS GPP values are concentrated within a smaller range and skewed towards lower values compared to the CCW output. This skew could be a manifestation of the resolution impact, with MODIS potentially averaging out high GPP values over larger pixels. In contrast, CCW model result shows a wider range of GPP values, suggesting more variation within the study area, possibly due to capturing more detailed variations at a finer scale.

➢ How spatial resolution impacts GPP estimation:

❑ **MODIS 500m:** At coarser resolution, each pixel covers a larger area, which could blend various land covers and their respective GPP within a single pixel. If heterogeneous landscapes are averaged into one pixel, the range of GPP values could become narrower and possibly lower if non-vegetated areas are included.

❑ **CCW_WaSSI Model 250m:** A finer spatial resolution could detect more variability within the same area, leading to a broader range of GPP values. If the shapefile delineates a forested area, the model may focus more on the vegetated regions, thus capturing higher GPP values and a wider distribution, as forested **pixels are less likely to be averaged with non-vegetated ones.**

- MOD17A2H GPP **underestimated** flux-derived GPP at most sites.
- MODIS-ET provides more reliable results. In croplands, MODIS-GPP can explain 80% of GPP variance, but it **overestimates flux derived GPP in non-growing season and underestimates flux derived GPP in growing season**; similar overestimations also presented in MODIS-ET.