Summary

Agriculture will unquestionably face tremendous challenges in the 21th century, among them adaptation to climate change, soil degradation, overutilization of agricultural inputs and simultaneously expected enhancement of crop production by almost 70% represent the most vital ones. On top of this, the transformation of agriculture needs to address holistic plant-soil ecosystem approaches that include the perception and practises of the majority of small-scale rural farmers, especially in regions most vulnerable to climate change as the state of Karnataka (India) with more than 50% of the geographical area affected by drought already, and with irrigation and electricity mainly dependent on rainfall (monsoon) patterns. Soils in (semi-arid) tropical regions like Karnataka are highly depleted in soil organic matter due to environmentally favoured high mineralisation rates, but also due to low inputs of organic matter to soils. Sufficient, long-term amounts of soil organic matter are key to durable soil fertility and crop production and need to be improved through sustainable agricultural applications in the near future.

The present master project will interdisciplinary address the challenge of organic matter applications in tropical agro-ecosystems by identifying on the one side the traditional, knowledge-based practises of small-scale farmers in the Berambadi watershed in south-western Karnataka in dealing with agricultural residues and, on the other side by testing the sole and combined effect of three organic soil amendments (compost, vermicompost and biochar) on selected functions of three different soils. Therefore, a combination of methods of human geography, including qualitative interviews (in-depth interviews with farmers and expert interviews), field observations and data analysis according to Grounded-Theory Methodology, and methods of soil science including field sampling, soil incubations, parameter measurements (carbon- and nitrogen contents, water-holding capacity, pH, enzyme activity) and statistical data analysis with R, is performed.

The findings of the study nicely highlight the complexity of identifying tailor-made agricultural, organic residue applications for any farming system when evaluated from both a socio-economic and agro-ecological perspective. From discussions with farmers on the one side it becomes clear that agricultural residues are mostly perceived as an agronomic resource and used for many domestic and agricultural purposes. Asked about expectations and doubts on technologies like vermicomposting or biochar applications, farmers can precisely name desired effects upon socio-economic and plant-soil systems irrespective of farming type, mainly improvements in soil fertility, water and nutrient status of soils and subsequently crop yield. Results from an soil incubation study on the other side overall shows that agricultural residue application exist, which can improve the quality of the studies soil. This largely depends on the soil function intended to be improved, and on the soil type the organic

matter is applied to. Surprisingly, it turns out that soils with the lowest quality (i.e. red soils) do not generally profit more from organic matter application than soils with higher fertility (i.e. black soils).

That some of the organic residue applications can address the changes in the soil ecosystems farmers desire, provides scope for successive in-depth field studies, where the effects are evaluated with organic matter coming directly from the agro-ecological context, farmers are living and working in.