

## 4. Bridging policy and practices in sustainable dairy farms in the tropics

Titus Apdini<sup>1\*</sup>, Corina E. van Middelaar<sup>1</sup>, Simon J. Oosting<sup>1</sup>

<sup>1</sup> Animal Production Systems Group, Wageningen University & Research, The Netherlands

\* Corresponding author. E-mail: [titus.apdini@wur.nl](mailto:titus.apdini@wur.nl)

Sustainable intensification of dairy farming implies to produce milk with less resources to reduce environmental impacts such as greenhouse gas (GHG) emissions. Many countries include sustainable intensification within the policy of dairy development, especially in the tropics where milk demand is predicted to rise. Little is known about the impact of such policies on farming practices. This study aimed to understand the implications of policies for sustainable intensification on dairy farming practices and GHG emissions using scenario analysis. We selected Costa Rica and Indonesia as case studies because both countries have formulated policy goals for sustainable dairy development but have contrasting farming systems. Information about current farming practices (i.e. the baseline) were collected on 45 dairy farms in Costa Rica and 32 smallholder dairy farms in Indonesia. Policy goals and environmental issues related to dairy production in each country were analysed to develop scenarios. The scenarios for Costa Rica encompassed the inclusion of a silvopastoral system and a reduction in the amount of purchased feeds, for two levels: 50% and 80% lower than the baseline. The scenarios for Indonesia encompassed a restriction on manure production to ensure all manure to be applied on farmland to grow forage, and a restriction on the amount of purchased feeds, with two levels: at maximum 100% and 50% of the baseline. Simple linear programming was used to maximise milk output per farm in each scenario, given the constraints on manure production and feed availability. We estimated GHG emissions and carbon (C) sequestration at farm and chain level. Compared to the baseline, the scenarios for Costa Rica reduced herd size, resulting in a 22-49% decrease of milk output, and a 25-55% decrease in GHG emissions per farm. The inclusion of a silvopastoral system increased on-farm C sequestration by 27-32% compared to the baseline. In case of Indonesia, the scenarios resulted in an increase in herd size, an 240-360% increase in milk output, and an 210-330% increase in GHG emissions per farm compared to the baseline. Estimates of C sequestration in Indonesia showed that establishment of dairy farms in primary forest as well as in plantation will contribute to a huge additional loss of carbon. Our study shows the complexity of formulating concrete dairy farming practices to achieve multiple policy goals.