

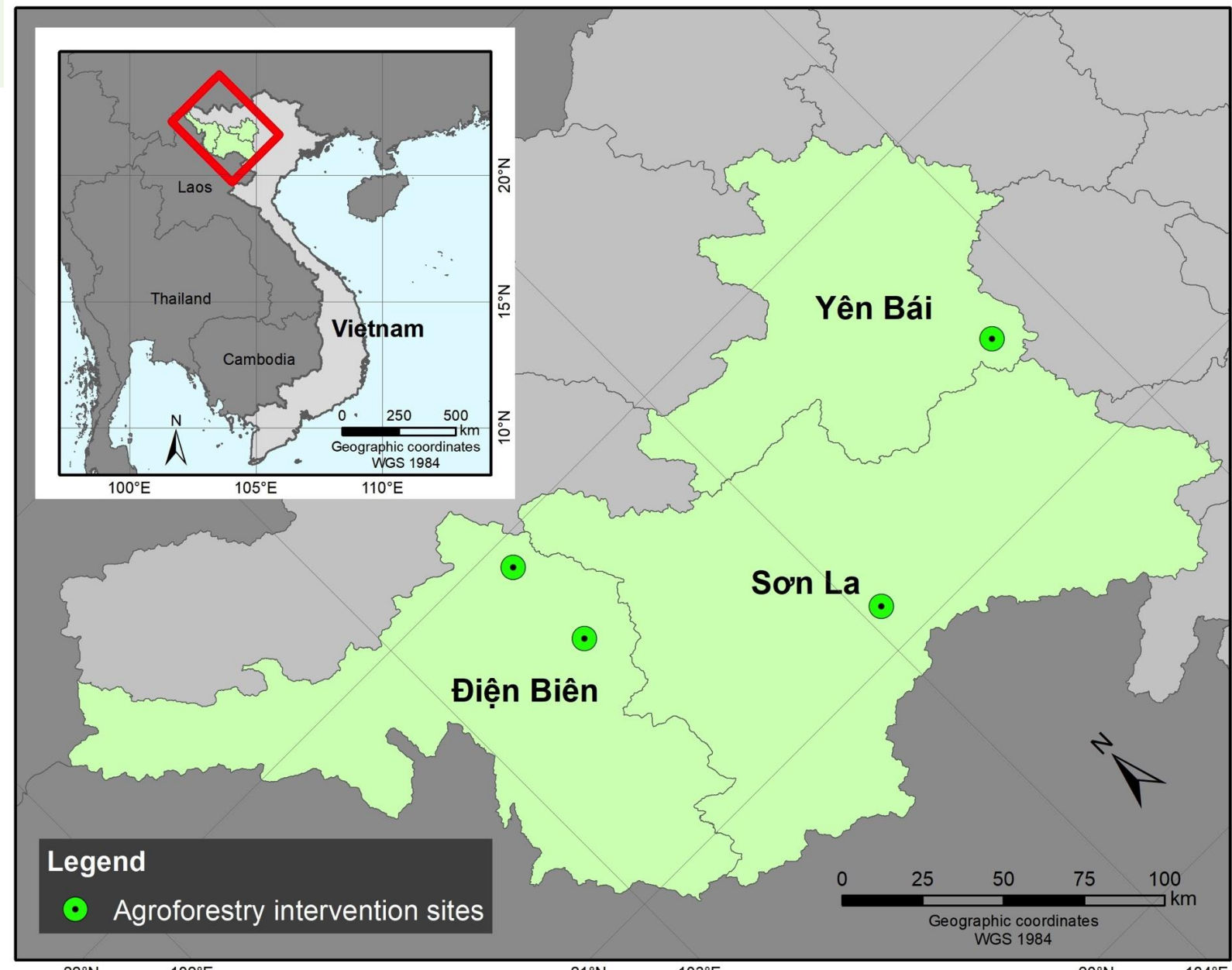


Agroforestry interventions

Land degradation and subsequent crop yield decline are the main causes of poverty and food insecurity. These are major livelihood challenges in the mountainous areas of northwestern Vietnam, home to many of the country's ethnic minority groups.

The World Agroforestry Centre (ICRAF) has trialed seven agroforestry interventions in the region.

We use decision analysis methods to produce assessments of their long-term performance considering all inherent risks and uncertainties.



Map of study regions in Northwest Vietnam

Decision Analysis

Decision analysis is an approach that aims to assist in decision making under risk and uncertainty. Decision analysis ...

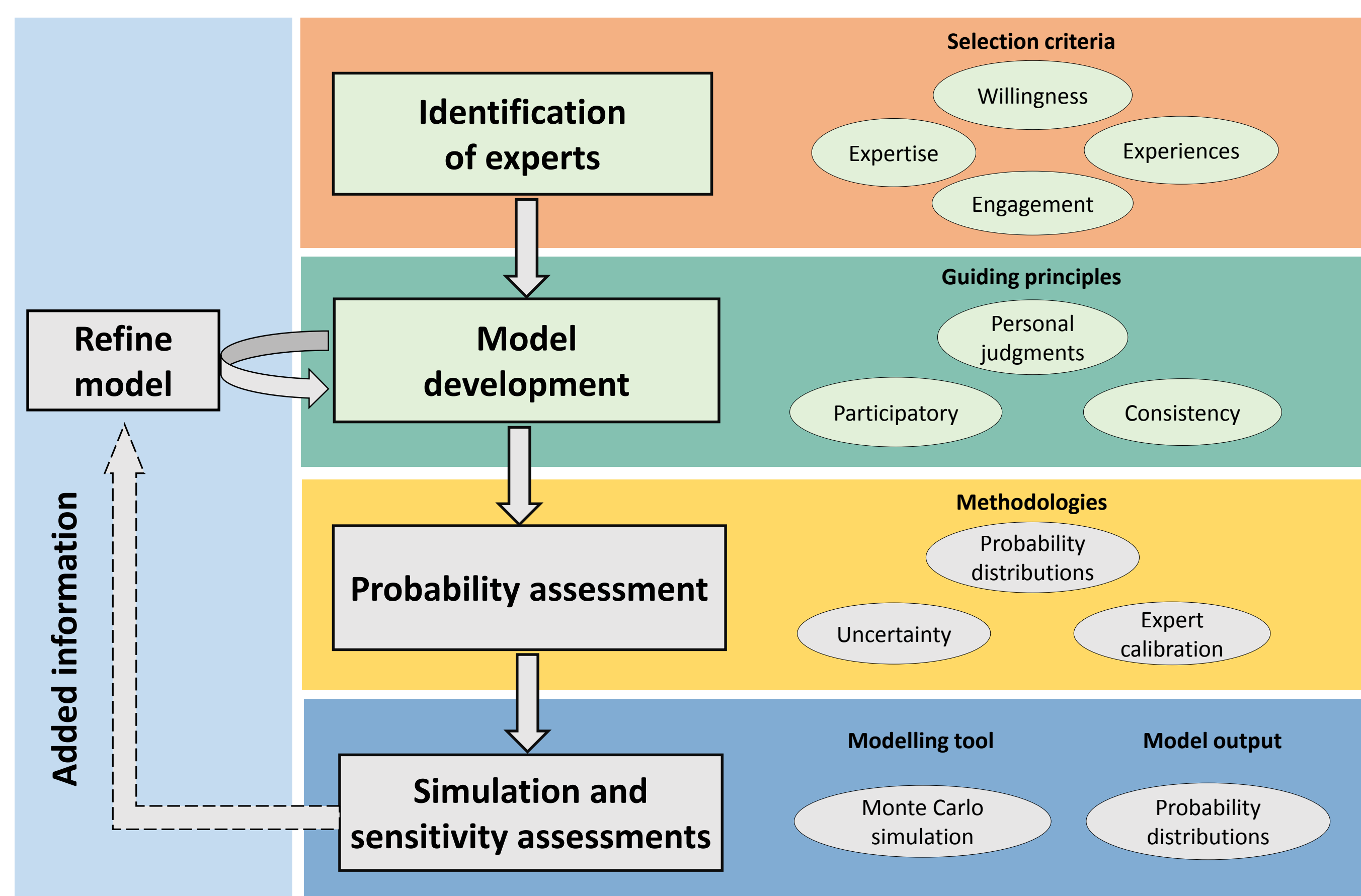
- can address uncertainty and provide cost-effective basic assessments
- incorporates multiple sources of information including expert knowledge
- aims to consider all risks and uncertainty
- uses probabilistic methods to handle uncertain inputs and represent uncertainty in the form of ranges or probability distributions (Luedeling et al. 2015, Luedeling & Shepherd 2016)

Study objectives

- Identify the main costs, benefits and risks of ICRAF's seven agroforestry interventions.
- Develop a conceptual cost-benefit model that includes risk factors involved in these interventions.
- Estimate confidence intervals for the net economic benefits of these interventions.

Method

We used participatory methods to create conceptual cost-benefit models of ICRAF's agroforestry interventions and coded these models in the R programming language (R Core Team, 2017). We predicted intervention outcomes using Monte Carlo simulation functions from the decisionSupport package (Luedeling and Goehring, 2017).



Decision Analysis process applied in Northwestern Vietnam: rectangles represent the main stages of model development

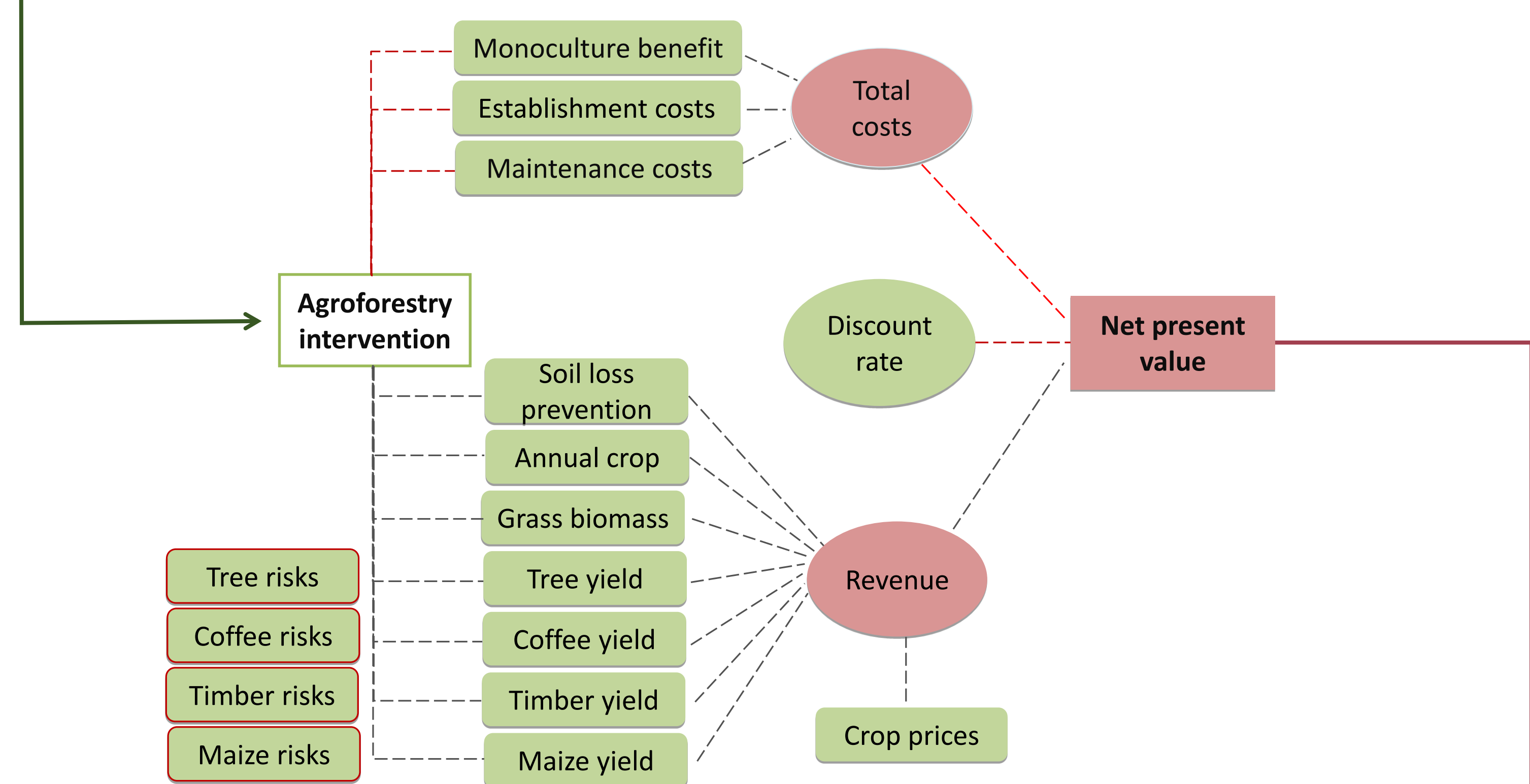
References

1. Luedeling E, Shepherd K, 2016. Solutions 7(5), 46-54.
2. Luedeling E, Oord AL, Kiteme B, Ogalleh S, Malesu M, Shepherd KD and De Leeuw J, 2015. Frontiers in Environmental Science 3, article 16, 1-18.
3. Luedeling E, Goehring L, 2017. R package version 1.103.6.
4. R Core Team, 2017. R Foundation for Statistical Computing.

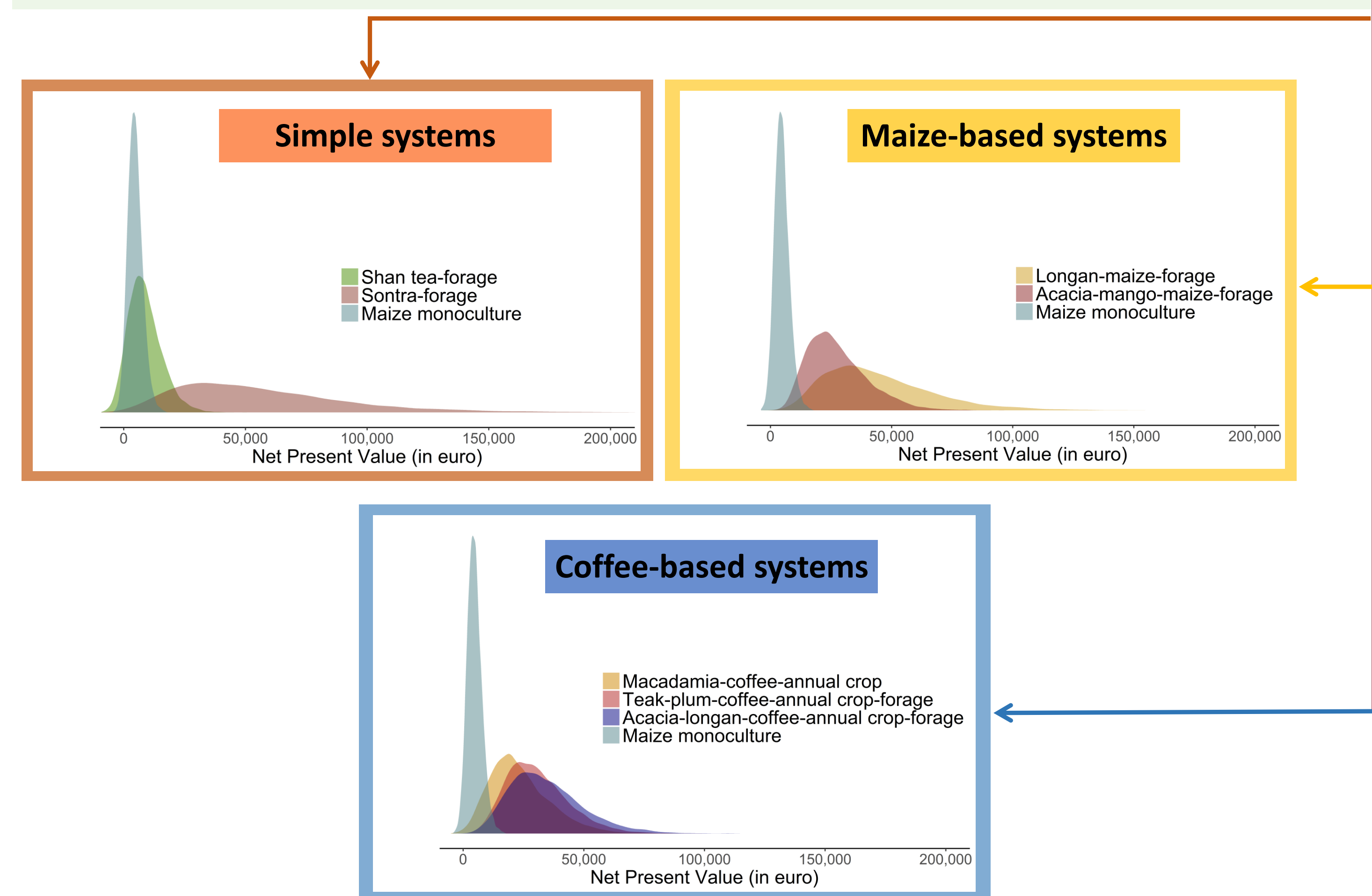
Results



The seven agroforestry interventions were categorized into three groups.



Conceptual model of costs, benefits and risk factors of agroforestry options. Green boxes represent estimated variables, red boxes represent simulated variables. "Tree" indicates Shan tea, sontra, longan, mango, plum and macadamia.



Model output distributions of net present value over 20 years for seven agroforestry interventions and maize monoculture system as control. The calculation was estimated for one hectare of land.

Key findings

- The most likely risks are extreme climate events such as drought, hot westerly wind and frost.
- Agroforestry interventions generate higher profits compared to monocultures in all model results.
- The most important uncertainties are discount rate, yields of fruit, coffee, macadamia and tea, as well as prices of crops.
- High initial investment and long payback periods are the main challenges that prevent local farmers from adopting agroforestry.