

# Co-designing an agent-based model to represent rainfed lowland rice management in lower Northeast Thailand

## Socio-ecological system & resource management

- Erratic rainfall distribution & coarse textured soils. Very limited irrigation network.
- Largest rainfed rice producing area in the country but low productivity ( $1.8 \text{ t.ha}^{-1}$ ) & low farm incomes resulting in high poverty rate.
- High migration rate can cause labour scarcity in the agricultural sector.

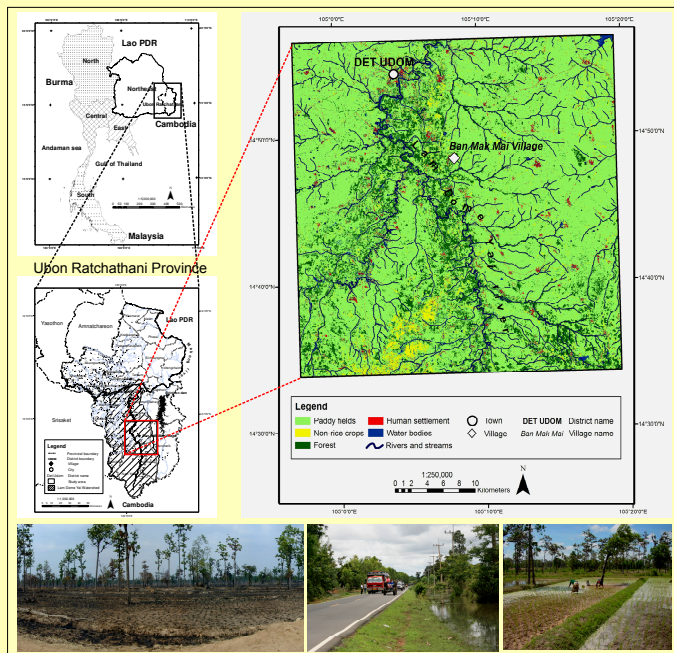


Figure 1. Location & agro-ecological conditions of study site.

## Study site & participants

- Located in the central part of Lam Dome Yai watershed, south of Ubon Ratchathani province.
- Intensive research activity carried out in Ban Mak Mai village.
- Three types of participating farmers:
  - 8 households: very small holder (approx. 3.2 ha) with land scarcity
  - 2 households: medium sized farms (approx. 7.2 ha) with labour scarcity
  - 1 household: large mechanized farm (8.6 ha)

## Research objectives

- To improve understanding of the interaction between land /water use & labour migration.
- To offer a methodology & tool that enhance the capacity of expression of the different stakeholders & communication among them.
- To stimulate joint learning through the collective identification, simulation & assessment of scenarios of change.

## Companion modelling process to co-design the Ban Mak Mai agent-based model (BMM model)

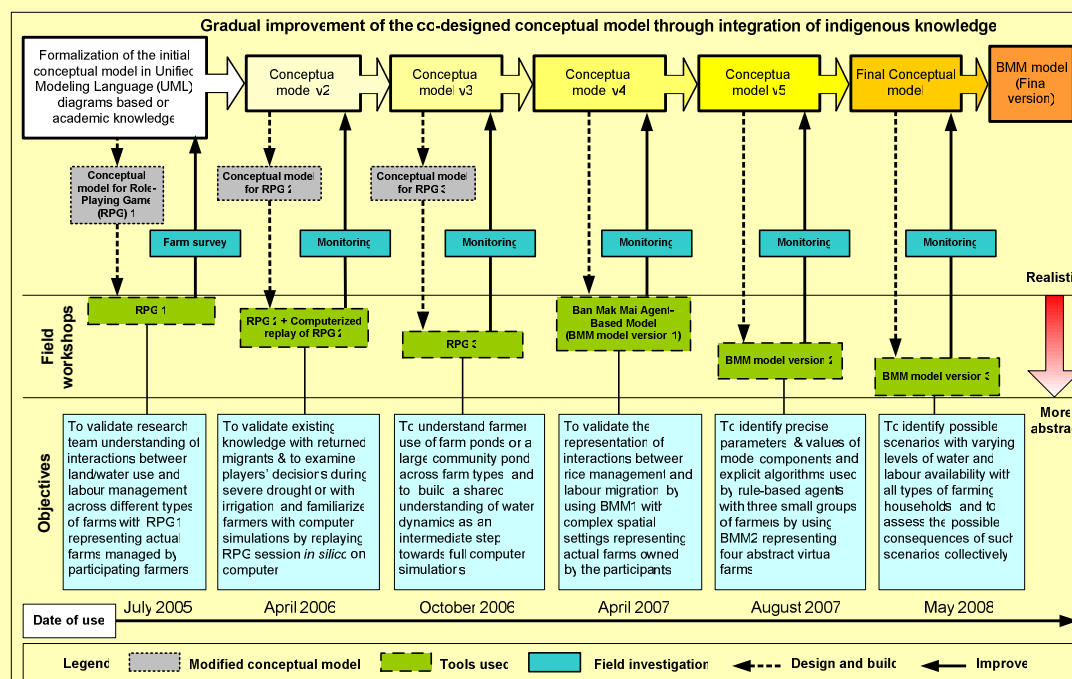


Figure 2. Companion modelling process implemented in the Lam Dome Yai watershed showing the evolution of the co-designed model, specific objectives of successive workshops & the tools used, 2005-2008.



Figure 3. First participatory modeling workshop with a role-playing game, on 9-10 July 2005.

Figure 4. Participatory simulation workshop using BMM model on 13-14 May 2008.

## Results & discussion

- The BMM model is a communication tool for knowledge exchange regarding the interactions between land & water use and labour migration in the rainfed rice environment & to integrate that knowledge into local practices.
- The BMM model is made of 5 key interacting entities: Member, Household, Village, Rice & Water tanks. Members & Households are rule-based agents representing local rice farmers.

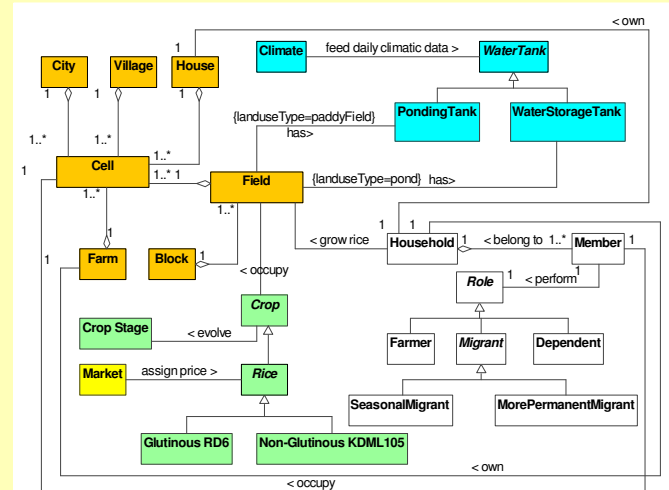


Figure 5. Simplified class diagram of the BMM model.

- Incorporating decisions & actions made in gaming sessions into the ABM increased the degree of contextualization, comprehensiveness & farmers' interest in using the model. As a result, they were comfortable & confident enough to present & comment the BMM model to outsiders.

Figure 6. Farmers using the BMM model to discuss with lecturers & master students at the local university on 8 October 2008.



## Conclusion

- The final version of the BanMakMai model integrates scientific and empirical knowledge, each part equally understood and accepted by the researchers & the participating farmers.
- Through co-learning & knowledge-sharing activities, farmers accepted that they better understood their rainfed rice system, particularly the interaction between rainfall & water availability on rice production.
- It is possible to collaboratively co-design a conceptual model & co-construct a computer model with marginal rice farmers & use it to explore the future scenarios.
- Through this innovative co-design methodology, participating farmers got a sense of co-ownership of the model & gained confidence in communicating across broader social networks to share their perceptions on rice & labour management.

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