

**ETH** Zürich**DUSYS**Departement  
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# Learning Begins When the Game Is Over

## Using Games to Embrace Complexity in Natural Resources Management

*We use games in the classroom to allow students to embrace the complexities of ecosystem management, and to foster adaptation and creativity.*

*The experience of gaming will ensure the lessons drawn during the game and the after-action discussions will not be easily forgotten. With a skilled team of facilitators, few other approaches to teaching can match the immersive qualities of gaming.*

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**Learning Begins When the Game Is Over.** Using Games to Embrace Complexity in Natural Resources Management  
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### Wicked Problems Enter the Classroom

“The world has problems, but universities have departments” (Brewer 1999, p. 328). Classical teaching and research institutions struggle to address the complexities of sustainable development and human-nature interactions. These issues are not “simply” complex. They typically involve multiple stakeholders that disagree on what the problem is. They unfold in a changing environment with pervasive uncertainty. These are “wicked problems” – others prefer “ill-defined problems” – that lack a commonly agreed upon definition. In such situations, solutions are not true or false but simply more or less acceptable to segments of the population.<sup>1</sup>

Tackling wicked problems in natural resources management requires a holistic approach that does not aim at finding definitive or optimal solutions but at triggering an adaptive process of collective learning, exploration and experimentation (Xiang 2013). This is the central message of our education project, aligned with the *Critical Thinking Initiative* at ETH Zurich<sup>2</sup>. We aim at developing the creative, critical and independent thinking capacities of ETH students (Baumberger et al. 2015). We make them aware of the nature of the problems they will be confronted with, and strengthen their capacity to foster and lead stake-

holder processes to address these problems in a real-world setting.

How do we achieve such an objective? Through drawing on our research on conflicts in conservation and applying the tools and methods we have developed for stakeholder engagement and participatory action research across the globe. In other words, we use games and promote participation.

### Games in the Classroom

A game is a model (Stähl 1988). A game poses challenges to the players, responds to their decisions and invites them to think strategically. Whereas the use of games in training has a long history in military academies, it is less frequent in the realm of business management and policy, and even less so in natural sciences departments. With the notable exception of *Fishbanks* by Meadows et al.<sup>3</sup>, games are still generally perceived as 1. not serious enough, 2. not realistic enough, and 3. not complex enough (Stähl 1983, p. 326).

Let us consider the first point. Games are fun. The fact that people, students in

this case, can forget their daily problems and immerse themselves completely in the world proposed by the game is what makes games such a powerful engagement tool. And if this also involves lightness and laughter, students will not object to four-hour long sessions. They will continue to discuss the topics long after the class has finished. Used in the introductory session of a course, a game will create a powerful emotional imprint on students and teachers alike, making it possible for them to refer back to what happened during the game weeks after the session. This is linked to the emotional responses players undergo when playing – beyond the rational and logic design of strategies, surprises, frustration and

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<sup>1</sup> [www.fordev.ethz.ch/research/glossary.html](http://www.fordev.ethz.ch/research/glossary.html)

<sup>2</sup> [www.ethz.ch/en/the-eth-zurich/education/policy/critical-thinking-initiative.html](http://www.ethz.ch/en/the-eth-zurich/education/policy/critical-thinking-initiative.html)

<sup>3</sup> <https://mitsloan.mit.edu/LEARNING/simulations/fishbanks/Pages/fish-banks.aspx>

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triumph, anger and joy, all can be experienced through a well-designed and well-run game session.

Realism, the second point of contention, seems a desirable attribute for any model designed to help decision making. However, the major difficulty when dealing with wicked problems lies not in understanding the bio-physical processes involved, but rather the values held by the various stakeholders, their segmented perception of the system, and their agendas, that at times appear to conflict, at other times genuinely do so. Thus, what matters with our games is to represent the stakeholders as well as their power and knowledge asymmetry. And precisely because a game session in the classroom involves real people with real brains, two major components of decision making are constitutive to the model: 1. bounded rationality, that is, the fact that a human is not a rational *homo eco-*

ger innovative, lateral thinking that seeks out the “What ifs ...?”. Our games seem simple when compared to the elaborate intellectual constructions of climate modelers and hydrologists. There are only a handful of different roles, of resources, of different tiles on the board. But the combinations rapidly explode – and overwhelm the cognitive capacities of the brightest minds. A game lets you navigate this complexity. Our models are complex enough to represent the interactions between ecological processes, individual decisions and collective action, create a challenge and allow learning. There is no need for more. Complexity, for its own sake, is a trap (Healy forthcoming).

#### Up for a Game?

We use role-playing games, both cooperative and competitive, to let students explore the roles of trust, knowledge, communication and conflict in a friendly environment.

palm belt of Cameroon.<sup>5</sup> It is played with small growers, cooperatives, plantation companies, downstream industries and policy makers to explore the complex and non-linear ways in which their decisions interact. But the game can also be used in the classroom, as was done last spring on two occasions, once at ETH Zurich with the Swiss Plant Science Centre,<sup>6</sup> and once with younger students from the French Lycée of Zurich<sup>7</sup>. The teaching objectives change according to the students: we expect Master’s and doctoral students to explore the resilience of the supply chain, while we expect high school students to gain awareness of the challenges of sustainability. But in both cases students were engaged, eager to explore alternatives, proposing new rules on the fly, and having fun. We even witnessed the creation of new roles, with teachers suddenly voicing concern about the environment and students responding by protest-

*Not all problems lend themselves to gamification – but whenever stakeholder strategies are the Gordian knot of the problem, games rock.*

*nomicus*, and 2. behavioural plasticity, that is, the fact that we learn, cope and adapt when receiving feedback. Our games thus offer a realistic representation of the social component of any natural resources management problem. And one that is notoriously difficult to capture in a classical model with standard approaches. In many respects, seeing free riders enter a protected area using the cover of anonymity during a session of our *ReHab* (*Resource & Habitat*) game<sup>4</sup> feels very realistic to anybody who has been in the field (Le Page et al. 2016).

As for the third point, the perception that games lack complexity: many of the comments we tend to hear at the end of a session deal with how the models could be improved – if we could only add mortality, market fluctuations, climate change, certification schemes, you name it. Players want to explore how this would affect the behaviour of the system. Would the outcomes be similar? How would the players react? Precisely this is our objective: we want to trig-

As the game unfolds, players observe, experience, experiment, and devise rules to resolve the tension between their competing demands. Collective debriefings allow lessons to be drawn on the reasons for success and failure. Unlike in real life, it is possible to start again from scratch, revisiting errors and exploring new solutions. Some of our games are generic, pitching players into classic “tragedy of the commons” scenarios, others are more realistic, developed through our research projects on specific issues related to natural resources management (see figure 1).

The oil palm supply chain in Cameroon is one such example. Decisions are taken at all levels of the supply chain, with far-reaching, often unforeseen, and at times unwanted consequences in terms of sustainability, efficiency and environmental impact. To overcome this challenge, we developed, as part of the OPAL (*Oil Palm Adaptive Landscape*) project, a role-playing game, *CoPalCam*, with stakeholders from the oil

ing against conservationists starving their children<sup>8</sup>. Our approach, using games, allows these kinds of storytelling to emerge.

Games can also move in the opposite direction, from the classroom to the field. As part of the *Conflict Resolution in Wildlife Conservation* course, ETH-USYS Bachelor’s students created games dealing with the issue of wolves in the Swiss Alps. The assignment was provided by WWF Switzerland, as part of their search for a negotiation tool to use for providing training about wolves and bears to hiking guides in the canton of Grison. The students developed four prototypes, and after testing them in-house,

4 [www.fordev.ethz.ch/research/our-games/rehab-game.html](http://www.fordev.ethz.ch/research/our-games/rehab-game.html)

5 [www.opal-project.org/commod-in-cameroon.html](http://www.opal-project.org/commod-in-cameroon.html)

6 [www.plantsciences.uzh.ch/en/rssnews/2016-09-20.html](http://www.plantsciences.uzh.ch/en/rssnews/2016-09-20.html)

7 [www.lfz.ch/fr/autres-informations-pedagogiques/projets-secondaire/sciences-et-mathematiques.html](http://www.lfz.ch/fr/autres-informations-pedagogiques/projets-secondaire/sciences-et-mathematiques.html)

8 [www.opal-project.org/news/opal-game-at-the-lycee-francais-marie-curie-de-zurich](http://www.opal-project.org/news/opal-game-at-the-lycee-francais-marie-curie-de-zurich)



**FIGURE 1:** Master's students of the ETH Zurich Foundations of Ecosystem Management course presenting a game on native woodland restoration in the Scottish highlands (autumn 2015). On the board, hunters, deer, tourists and fences shape the landscape, while the players, estate managers or government agencies try to pursue their own objectives – adding value to the estate or increasing the native tree cover across the landscape, respectively.

WWF picked one of them for use in the field. The purpose of the game *Stadt Land Wolf* is to debate the allocation of public funds among four different policy measures, namely, protected areas, herd protection, information campaign and culling. Each player represents a stakeholder (farmer, hunter, forester, politician, environmentalist, urban dweller), each with their own stance towards wolves, be it pro, contra or neutral, and makes decisions based on the situation they see on the board.<sup>9</sup>

### Handling the Game

No matter how much fun and engaging a game is, it was brought to the classroom with a purpose. In the field, a game acts as a platform to better understand a system and seek solutions to problems. In the classroom, the main objective is learning. Learning happens during the game itself, as a player observes the impacts of decisions and receives feedback on actions. Collective learning can be fostered by discussion. The entire purpose of a game session lies in the debriefing after the game is over, a forum for drawing lessons and critically reflecting on the collective and individual out-

comes. Games only matter as long as you can have this discussion. “The real learning begins when the game stops” (Tipton et al. 2016).

### Conclusion

As we have discussed, games are a powerful tool for engaging students, letting them explore the complexities of a system, and giving them the opportunity to deal with wicked, ill-defined problems in a safe and fun environment. The concepts, tools and methods are not context dependent and can be easily adapted to any topic where stakeholders' engagement and uncertainties are critical (energy transition, urban planning, adoption of innovation, etc.).

The games can be used for their ice-breaking and/or team-building potential. They can serve as vehicles through which to explore in depth the subtleties of a real case. The experience of engaging in the game will ensure that the lessons drawn during it and from the following discussions will not be easily forgotten. Provided a skilled team of facilitators handles the games, few other approaches to teaching can match the immersive qualities of playing games.

Naturally, not all problems or scientific questions lend themselves to gamifica-

tion – but whenever stakeholder strategies, with their bounded rationality and learning capacities, are the Gordian knot of the problem, games rock.

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<sup>9</sup> [www.fordev.ethz.ch/news-fordev/2016/07/conflict-resolution-in-wildlife-conservation.html](http://www.fordev.ethz.ch/news-fordev/2016/07/conflict-resolution-in-wildlife-conservation.html)