Games for the redesign of farming and food systems
FSE32306 Group Work

Name of the game:
Aridia: Droughts of Andalucía

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Game Booklet

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Game Concept

The game is about three farmers that produce all the same crop (olives) for the market. The setting of the game is in southern Spain where water becomes a scarcer resource over time. In the game there is not a set time frame, but the period is roughly from the time that water was not an issue in southern Spain until the future where water will be a huge problem. During the game every farmer has their own specific aim. The aim of the farmers is to continue producing their crops the best they can, each with a different irrigation method loosely representing their general perspective on the importance of a dwindling water reservoir. One farmer will keep the same irrigation system with a higher water use, one farmer will slightly improve to an irrigation system with a lower water use and one will improve to an irrigation system with the most efficient water use. In essence, the objective of this game is to raise awareness of the impact and importance of different farming practices on a landscape facing more frequent and severe droughts.

In the game the main challenge the players will face is the increasing water scarcity. Water is in the beginning an 'infinite' resource but when the game processes the water will be limited by events cards until there is no more water left for the players to all participate in the game anymore. This will be the end of the game and the debriefing will start about the end situation. The experience that we have implemented into the game is relevant for players because it gives them the realization that water can be a scarce common resource which must be taken care of by all actors.

In the initial design of the game the purpose of the game as an individual experience was to earn as much money while keeping the farm in business. For the collective experience the purpose is to keep enough water in the reservoir to get a sustainable water level in the region. Although these purposes are still in the game, the final design is more scripted and gives players not really the choice to achieve this purpose. The final game gives more of an experience of what would happen in a water scarce situation if all the players had a different purpose.

Setup

The main components of the game consist of three farmers, a market, and a water reservoir. On the board each farmer has its own piece of land to grow crops and a spot to place their money tokens. The market is visualized as a square on the bord where seeds will be bought, and crops will be sold. The water reservoir is on the right of the market and will have a spot for all the water tokens. Furthermore, in the middle of the board there is a wheel which shows the order of events for every round and underneath there is an indicator that shows in which round the players are. Above the market there is an overview of costs and prices depending on the farmers' practices. Underneath the wheel that indicates the rounds there is a spot where event cards will be placed, the active cards will be faced up and inactive cards will be faced down.

On the bord water tokens are placed in the water reservoir, crop tokens are places outside of the board, five money tokens are given to the farmers and the remaining money tokens are placed outside of the board, a sun is placed to indicate the round and event cards will be placed on their designated spot during the game. Outside of the board each farmer is given a role card on which the farmer can read what their desired farming practice is

in the game and a water anxiety card on which they can indicate their anxiety levels each round. Outside of the board there also is a stack of surprise cards which will be used in the third round of the game.

How to play?

At the beginning of the game all farmers have five money tokens and a role card on which the farmer can read what their desired farming practice is in the game. The wheel will indicate the order of events in each round. The first event is 'paying for the practice' here all farmers must buy their seeds for the growing year at the market, these cost one money token. The next event is 'paying for improvement' here the farmers who must improve according to their role card must pay two money tokens for their improvement this will only happen in the first two rounds. The next event is the event card which will only start to happen in the second round of the game and will be placed on the desired place, active cards will be placed upwards, inactive cards will be turned around. The next event on the wheel is 'take the water needed for your practice' here the farmers will all get the water they need to grow their crops, the farmer who did not improve will require three waters, the farmers who did improve require two waters. Followed by the event 'use the water to grow crops' where the farmers trade their water for crops, the farmers that did not improve will grow three red crops, the farmer who improved one will grow two yellow crops and the farmer who improved twice will crow three green crops. After crop growth comes 'sell the crops on the market' where all crops will be bought by the market for two money tokens. The next event on the wheel is 'replenishment of the water reservoir with rain' here due to rain the water reservoir is filled for the next growing year. The last event on the wheel is 'indicate your anxiety for water scarcity' where all farmers must fill in their indication card.

After the first round each round an event card will be played which will influence the game, some will be active the whole game and some will be active for only one round.

In the third round of the game surprise cards will be introduced. The surface irrigation and sprinkler irrigation farmers can choose from three cards depending on the practicing role of the farmer. All cards would have a different outcome in the game and can have a positive or negative consequence for the farmer.

Debriefing

In the debriefing the following questions are addressed to stimulate a reflection and discussion among participating players:

- How do you feel about the division of the water in the last round?
- How do you feel about the difference in money?
- From which round did you have anxiety for the water running out?
- How do you feel about the role you as a farmer had in the water scarcity?
- What do you think the different colors of the crops mean?

These questions serve as critical opportunities for reflection on the experience of our serious game setting, enabling participants to investigate their emotional reactions, perceptions, and understandings of many parts of

the gameplay. Discussing over these questions provides participants with insights into the climate change complexity and impact on water management and irrigation practices in Andalucía, improving both their grasp of the game and promoting meaningful debate about urgent environmental issues.

Appendix: Game Design Process

Challenge Definition

Spain faces an acute water crisis due to recurring droughts. This ongoing is linked to climate change, as Spain is one of the 33 countries predicted to face extremely high water stress by 2040 (World Resources Institute, 2015).

Water scarcity is compounded by significant demand from intensive agriculture. Abstraction for irrigation has skyrocketed as the country has become "Europe's fruit basket". Spain is the European country with the largest area of irrigated land[1], which consumes 80% of annually used water resources in the country. Yet, in 2019, the agribusiness sector reported drought-related losses of EUR 1.5 billion.
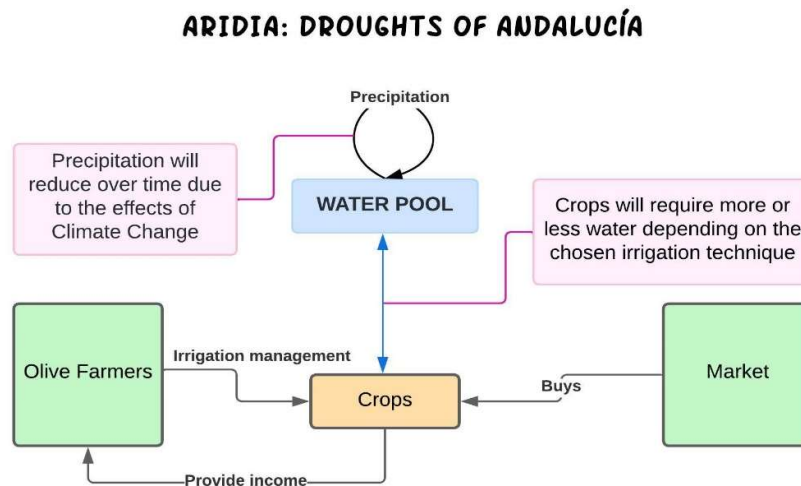

Figure 1 Conceptual model of the game.
In green the two actors (the consumers represented as the market, and the farmers which are the only actors controlled by the players), and the crops that depend on the water pool, which restores itself through precipitation

Even though southern Spain is the driest region of the country, intensive agriculture takes place, damaging important ecosystems such as the Doñana wetland[2], and jeopardizing the future of Andalusian livelihoods. As shown in the conceptual model in figure 1, the challenge is represented in the game by showing the effects of farmers on the common water pool due to the irrigation practices selected by them.

Actors and Resources

In the final game there are three actors which are the three farmers, and the resources are crops, water and money tokens. The water and the crops are a finite natural resource, and the money tokens are a finite human

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[1] 14.5% of agricultural land (Indexmundi.com)
[2] https://awsassets.wwf.es/downloads/agricultura_donana.pdf?_ga=2.41761957.626374466.1714549744-1381041290.1714549744

resource. The farmers interact with all the resources. In each round all the farmers get the water that they require in order to apply their practice. This water is converted to crops. The crops can be sold for money tokens on the market. Farmers can use the money tokens to buy their practices, to improve their practices and later on in the game also in order to buy water. In the game there are other actors, but they don't really actively play a role in the game. They are the market which buys all the crops from the farmers but doesn't distinguish between farmers' practice and authorities or activists who are involved in the game by surprise or event cards.

During the game process we were quite clear on which actors we wanted to implement. We wanted to have farmers and consumers in the game, because farmers decide how food is produced and consumers can decide which food they want to buy. We thought these actors would be interesting to combine because this would show how consumer choices would affect farmers willingness and capabilities of choosing a practice. However the different practices don't really result in a different product, because there is no certification for low water use, so the price would not differ per practice. From a consumer perspective the products would have had the same price and the same quality, so their choice would be based on what farmers did and this is not visible in real life. Because of this we decided to change the consumer for the market, which didn't distinguish between farmers' products.

Dynamics and Interactions

The basic dynamic of the game which repeats each round is that farmers pay for their practice and improve their practice if they can. Then use water from a common water reservoir in order to produce a crop with a yield that corresponds to their practice. These crops are then sold to the market in exchange for money tokens. At the end of the round rain is introduced (this starts in round 3).

As addition to this basic game dynamic each round apart from the first-round events cards are introduced. These event cards are mainly focused on influencing the amount of water that is in the reservoir. The first event, which takes place in round two, is introducing a drought which means making the water tokens limited to fifteen water tokens. The second event is introducing rain in order to recharge the water reservoir. The rain is each round half of what is used in that round. In event three the farmers have to pay for their water, which will be two money tokens per water token. This will stay for the rest of the game. The fourth event will be that the drip irrigation farmer retains one water token on his land for the rest of the game. The last event, when there is no water left anymore to satisfy the production of all farmers, will confront the players with the question who will get the water that is still left in the reservoir. The game also contains surprise cards for the farmer that has surface and sprinkler irrigation. They can choose between three cards. All the cards for the farmer with surface irrigation will negatively impact him and all the cards for the farmer with sprinkler irrigation will positively impact him.

At first we wanted to incorporate the dynamic of demand and supply into the game, with also having a consumer as actor. However the game would then have been too complicated and would not every scenario result in the end situation that we want to show to the players.

The dynamics that we created are based on both real data and on our own perspective. The ranking of the yield and water use of the various practices are similar to the real world, but the ratios and numbers aren't comparable to the real world. This is done to keep the game simple and clearly visible.

Further Research

To improve the current prototype game, one change in the game design process could be including a player who plays the consumer role. This might provide a more realistic representation of the consumer-farmer interactions. The consumer, having for instance a limited budget and a minimum food demand every round, would be free to choose which farms to support. While they may select farms with better water-use practices, budgetary limitations may force them to purchase less sustainable choices occasionally. Furthermore, allowing farmers to choose when and if they wish to enhance their methods adds depth to the gameplay. Finally, adding pricing variations on the crop sold to the consumer depending on agricultural practices, for instance seen in organic vs non-organic, would enhance game experience by reflecting real-world economic variables. However currently there is not a specific certification for low water-use which could prove challenging to incorporate this into a game if trying to represent a real-world mechanic.

The current setup, with a facilitator assuming the role of the consumer (market), might remove players' comprehension of the consumer's role. Moreover, constraining farmers to Role Cards limits their realistic autonomy, especially in response to environmental changes like rapid water reservoir depletion. However, these limitations may also reflect the reality often observed in agricultural practices, where deeply established practices resist change.

Regarding other future opportunities of the game, by incorporating aspects where farmers living next to bad-practice farms also face repercussions, such as landslides due to oversaturated soils, the game would foster dialogue among farmers and promotes the adoption of better land use practices. There could also be further crop pricing dynamics, where the prevalence of good farming practices leads to lower costs for consumers. This, in turn, could incentivize government subsidies to sustain farms and encourage continued adherence to these beneficial practices.

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Individual Reflections

Davide – Learning goal: **Game design**

The personal learning goal I want to focus on for our serious game creation is purely design-related. The drawing app called Procreate has been sitting on my iPad's home screen for a while, and I thought this would be the perfect moment to start working on my drawing skills by designing the board and some of its components. Witnessing how a simple white prototype A1 sheet with squares and sticky notes transformed into a detailed and colorful board was incredibly satisfying and fulfilling. Furthermore, thanks to our excursion to Twente and Jonathan's explanations, I gained insights into turning images into vectors for laser cutting and selecting suitable wooden bars. This is undoubtedly something I wish to delve deeper into in the future, especially after discovering the presence of a design lab facility on the Wageningen campus. My take home message is that exploring creativity and design in academic learning provides an exciting and more stimulating alternative to traditional group activities.

Jesse - Learning goal**: Game design**

During the game design process we as a group had quickly an idea on what we could do with the game. We had all roughly the same idea so that was nice. We had a lot of ideas on what we could add and modify. This was also what we did in the first few days. We came up with ideas and wrote them down. However we didn't really test them yet. This is what we realized and thus we started to test the game and experienced quite quickly that all the dynamics and interactions that we wanted to add would make the game too complicated and not playable. So we needed to redesign the game and scrap a lot of our ideas. After we did this we tested the game again but still found out that we couldn't really get to our objective if some scenarios were taking place. So we decided to make it even more scripted, which meant that every farmer was playing a fixed role. When we tested the game this worked out and our objective was reflected into the game.

However during the game sessions I experienced that the game was too scripted. During the event the players couldn't really incorporate their own vision into the game. Of course, this was partly the intention but during the debriefing it was hard for some people to explain their decisions. So to find the right balance between reaching the objective and letting players incorporate their vision in the game was for me hardest part of the game design. I also learned from the game design process that testing and simulating a lot of scenarios is the best way to come to a good game.

Jonathan – Learning Goal: **Conceptual Model**

We started with a concept that highlighted interconnectivity between consumer and producer in a drought-heavy landscape and eventually shifted our focus to how a farmer's practices affect the local water reservoir, removing stakeholder interactions illustrating relations between farmers. Nevertheless, I believe that our game still reached its goal: detailing how the responsible use of water for agriculture in an arid area requires participation of all local farmers in pursuing practices that promote water retention in the soil and generally less water-use – otherwise, there is not much future for the community's ability for food production. This said, it is intriguing the possibilities

of making this game allow for more social interactions between farmers as well as with the consumer. Recognizing time available to craft a prototype game and needing to firmly decide direction for the game was a personal take home message for me. In the end, we could have continued down our initial prototype path. However, to have a final, interactable game, we could not be dancing between two different conceptual model options, and we decided ultimately and unanimously to choose the path that removed some complexities and possible player interactions. It will be valuable to keep this lesson in mind for future projects and group work – it is always possible to make a project or model more adherent to reality; however, when there is a deadline, it is necessary at times to recognize what is most important to convey, make firm decisions based on this, and not look back. Further developing this skill and my understanding of this lesson I think will come naturally with more projects and group work of mine. Throughout and looking back, I have had a very enjoyable time working on this project with the team and am happy to have had this opportunity.

Marieke – Learning goal: Game design

When receiving the assignment to design a serious game about increasing drought in the south of Spain, this was initially very broad. We quickly realize that there are a lot of influences that can be represented in a fussy mapping. However, not all influences can be reflected in the game. As a result, we had to consider what discussion we wanted to provoke and what message the game we had developed should have. We started with a game where many choices could be made by players, but the message was very much pushed to the background. We chose to make a scripted game. This is less fun for players, so we added event cards and surprise cards to keep the element of surprise in the game. However, the feedback was that a serious game is the most fun when more choices can be made by players. While playing there were some very nice and good discussions, but because everything was already fixed in the game, players could not respond to this in the game. Our game is designed to be virtually impossible to achieve sustainability in terms of water, which also gives players the feeling that they cannot win the game.

What I have learned from this process is that being able to make choices makes a game more fun and that the desired result must be achieved with these choices to achieve the feeling of winning. In the future I would like to take into account that the requirements of the end product must be carefully taken into account at the start of a development phase. If we had more time, we would have wanted to further develop the game so that choices can be made based on the discussion that influences the game.

Mario – Learning goal**: Facilitation**

During the playing session I took the role of "main facilitator" in the game, which basically consisted on storytelling and trying to keep the rhythm of the game. I had never played serious games prior to this course, and I think it became really apparent to me how facilitation is key in keeping the players attention and engagement, and also maintaining the idea and objective of the game in the players' minds, especially when it is a scenarized game such as ours.

To develop my facilitation skills, I would focus on the following specific points:

- ➤ Planification: In a serious game, the equilibrium between what players already know and the information they obtain during the course of the game or in the debriefing has to be carefully thought of, so that the process of the game is clear and understandable, while at the same time containing surprises, which can improve the learning effect and make the game enjoyable.
- ➤ Time-keeping: The game can become boring if too much time is spent in some specific moments, moreover considering time can be lost in discussions that are supposed to take place later in the game. An equilibrium must thus be found between the freedom you give as a facilitator to the players' interaction (which is one of the most important and interesting parts of game research), and the respect of some time limits to keep the game flow and the occurrence of new events.

My take-home message is that facilitation is not a role you can improvise, and that ideally, each of its aspects must be carefully planned with respect to all the elements that happen in the game and the message each moment is expected to convey.

Cards, Board, and Pieces

Cards representing the farmers

Role card

SURFACE irrigation farming system

Surface irrigation works by letting gravity divert water from a source like a river or canal onto fields. The water then flows over the soil surface, spreading through furrows or basins. This technique does not require electrical input, which means it has been used for millennia, and remains the most used means of irrigation worldwide

Role card

You are the family **García Rodríguez**, and you own a farm in the rural town **Monteblanco de las Flores** in which you cultivate olive to produce the **"Olivar del Sol"** Olive oil bottles.

You have heard in the news that the land in which you were born, southern Spain, is going to face huge water strain in the coming years and decades, due to climate change.

However, you realize that you are earning considerable amounts of money thanks to your irrigation method, and you believe you and your family will be best off by keeping the production systems as they have always been.

You therefore choose to keep prioritizing high yields… Even at the cost of using more water than other farmers in the area

Role card

SPRINKLER irrigation farming system

Sprinklers work by distributing water through a network of pipes with sprinkler heads placed across the field. Water is released in a controlled manner, simulating rainfall and generating a uniform cover of water droplets on the soil, which minimizes water wastage compared to surface irrigation

Role card

You are the family **López Pérez**, and you own a farm in the rural town **Monteblanco de las Flores** in which you cultivate olive to produce the **"Aromas del Olivar"** Olive oil bottles.

You have heard in the news that the land in which you were born, southern Spain, is going to face huge water strain in the coming years and decades, due to climate change.

Your family has been farming in this town for generations, using surface irrigation as the standard technology, but even though you have never had sustainability as your top priority, you know the importance of water.

After consideration you chose to implement sprinklers, as subsidies to enable a higher investment had too heavy bureaucracy attached to them

Role card

DRIP irrigation farming system

Drip irrigation works by delivering water directly to the roots of plants through a network of tubes with emitters spaced along their length. Water is released slowly, near the plant roots. This targeted delivery minimizes water loss due to evaporation and runoff, resulting in highly efficient water use.

Role card

You are the family **Martínez Fernández**, and you own a farm in the rural town **Monteblanco de las Flores** in which you cultivate olive to produce the **"Oro Andaluz"** Olive oil bottles.

You have heard in the news that the land in which you were born, southern Spain, is going to face huge water strain in the coming years and decades, due to climate change.

Your family has been farming in this town for generations, and you know that rough hydrological times are on their way! You therefore lose no time and design a phased adaptation plan first involving a sprinkler irrigation design, and then investing in a carefully designed drip irrigation system.

No effort is excessive to preserve the historic livelihood in Monteblanco de las Flores for generations to come!

Event cards

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5. Who gets the water?

You have reached the endgame. Choose wisely...

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4. Water Retention

At least someone is earning the benefits of the early choices... Some water is retained in the drip irrigation crop

3. Water Pricing

The government water company, "Aguas de Monteblanco", has decided to charge farmers for their water use. Scarcity comes at a price!

2. Rain

A well-needed recharge arrives to save the year…

For now at least

1. Drought

Oh no…
It looks like the water reservoir is down to 15 units.
Climate change is really starting to be felt in Andalucía

Surprise cards for sprinkler irrigation farmer

Water subsidy!	Practice subsidy!	Activists Support!
Government covers the water cost. Points for the effort!	Government is covering capital cost for sprinkler irrigation!	Civil society is supporting your products
0 water cost this turn	0 practice cost this turn	+1 token per sold crop this turn

Surprise cards for surface irrigation farmer

Landslide!	Activists Occupy!	Waterlogging!
Accumulated erosion leads to a landslide on your crops.	Water is life!! You cannot drink money!!	Your soil is saturated with water. Bad news for your trees
-3 yield this turn	-1 yield this turn	-2 yield this turn

Water anxiety level card

Water anxiety level

Round 1

Round 2

Round 3

Round 4

Round 5

Round 6

Round 7

Vector designs for laser cutting and engraving

MARKET PLACE

Drip Irrigation

Sprinkler Irrigation

Sprinkler Irrigation

Surface Irrigation

Surface Irrigation

Surface Irrigation
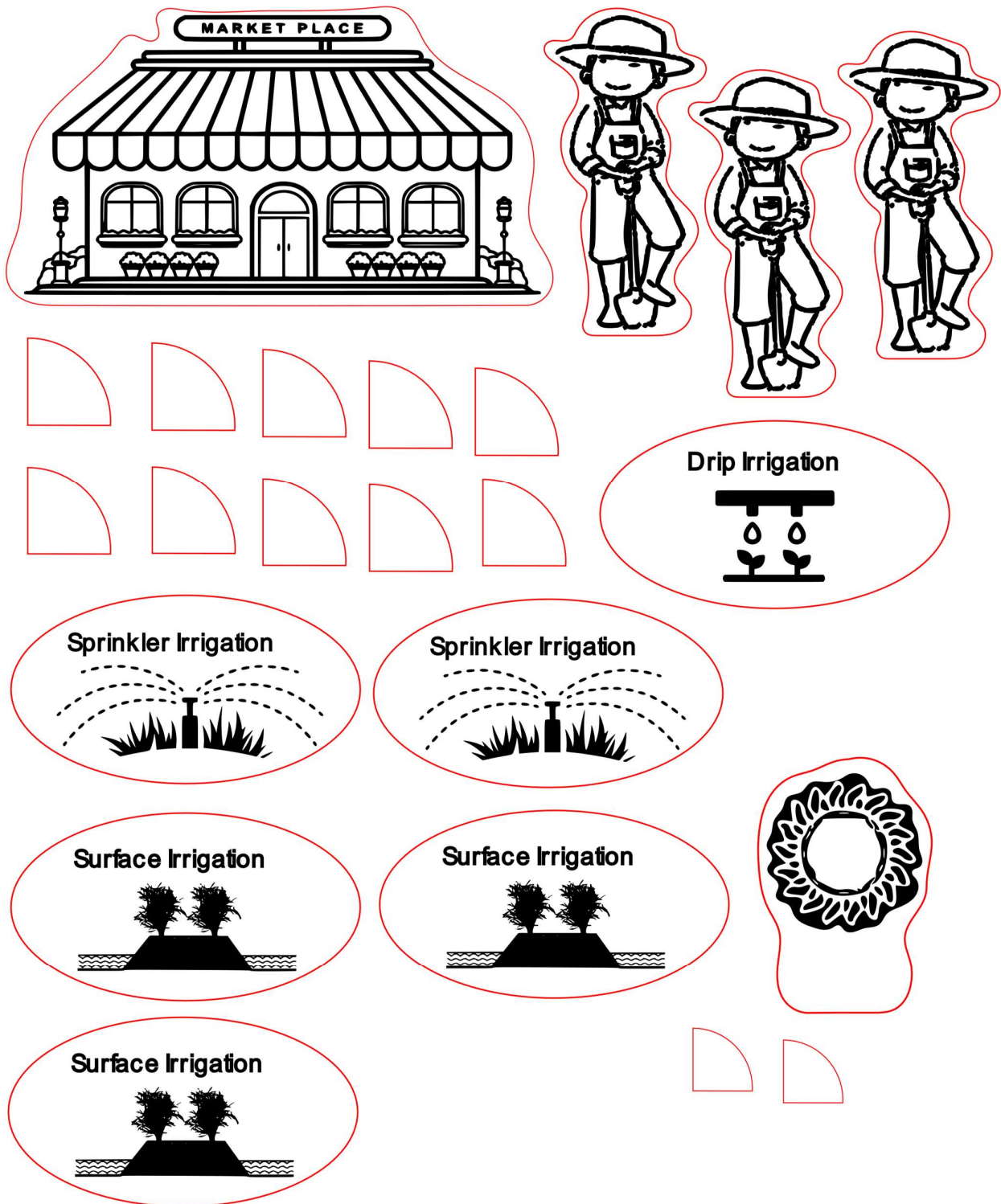
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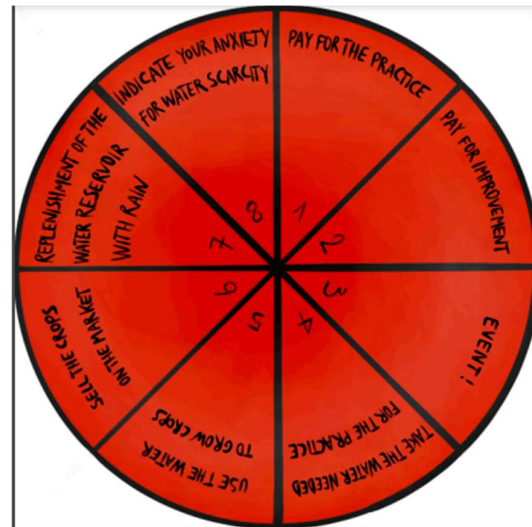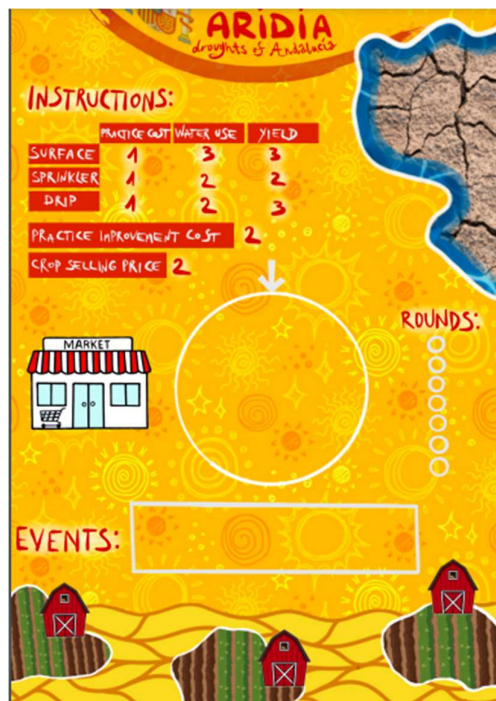
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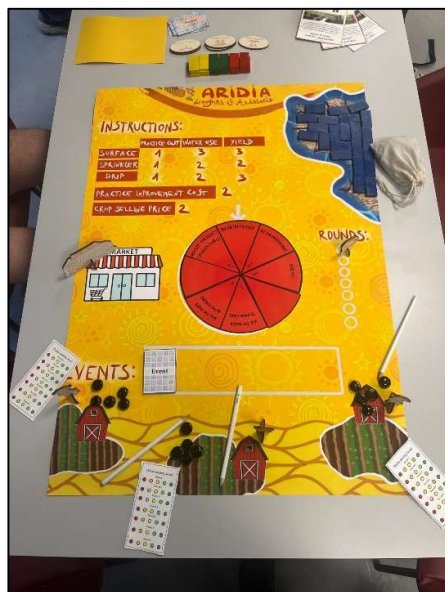
Game in-session

Acknowledgements:

This booklet and the game design process was designed and used during the MSc course FSE32306 by:

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This booklet and process is adapted from the Companion Modelling Approach, ComMod, the ARDI method (Etienne et al. 2011) , and Page et al. 2016.