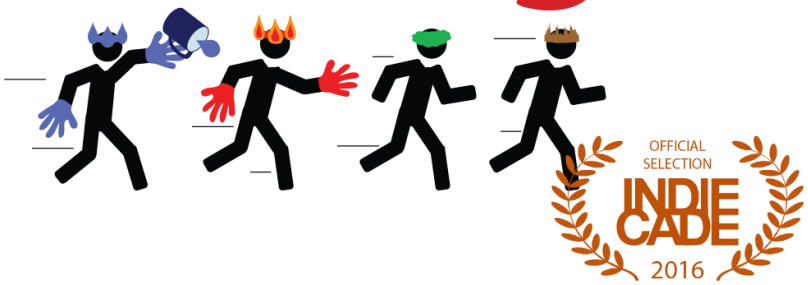
Fire Tag



Abstract

An Official Selection of IndieCade 2016! *Fire Tag* is like *Freeze Tag*, but smarter and sillier. In *Fire Tag*, players take on one of four roles - Grass, Shrub, Fire, and Rain. Being both a game and a simulation, *Fire Tag* is also an experiment in landscape ecology. During the game proper, players learn basic ecological facts through play. During the post-game discussion, the game facilitator (a.k.a. Game Master, or GM) helps to highlight parallels between in-game patterns and real world landscapes. This helps players understand deeper issues in fire ecology, systems thinking, and scientific modeling - all while inspiring a love of science, nature, and learning.

Quick Activity Stats

- **Audience:** Curious humans ages 6+
- **# of Participants:** 10 - 40 players
- **Time:**
    - Teacher/GM prep time: 20 min.
    - Game/activity time: 30-60 min.
        - Construct costume hats (with player help) - 20 min.
        - Play time - 20 min.
        - Discussion time - 5-20 min.

STEAM-y

This document

- Connections to NGSS Standards
- History and Licensing (public domain)
- Game and Lesson Guide
- Core Discussion Guide

NGSS Friendly!

Accompanying materials

(**free** downloads from Mindful Mammoth or TPT)

FREE

- Rules Poster
- Easy Costumes
- Results Poster
- Results Icons

A project of:

MINDFUL MAMMOTH

History and Licensing

I developed *Fire Tag* back when I worked for the Santa Monica Mountains National Recreation Area. With this project, my goal was to create a fast, fun, and thought-provoking activity for the 2012 Santa Monica Mountains Science Festival. Being a product of the National Park Service, *Fire Tag* is firmly in the public domain.

The good news is that 100+ kids enjoyed *Fire Tag* at the 2012 Science Festival. The bad news is that after I left the NPS, *Fire Tag* got lost among the many good ideas competing for very limited funds. This seemed a terrible shame, so I've updated the rules and materials, and made them freely available on the web through MindfulMammoth.com and Teachers Pay Teachers.

In 2016, I submitted *Fire Tag* to the International Festival of Independent Games, IndieCade. To my great surprise and joy, it was chosen as an Official Selection of the 2016 festival. As a selection, we were allotted space in the festival, and in that time we shared the game with 100+ people both young and old!

As I expand the educational scope of Mindful Mammoth, I hope to begin using *Fire Tag* in some of our outreach programs with local groups. I also hope that other folks may find this game and try it out with their students, kids, families, and friends. Maybe you will do this. I hope so!

Good luck!

Tim Handley
Founder, Educator, and Game Designer @ Mindful Mammoth

P.S. If you do give this a try, please tell us how it went! We're always happy to talk.
You can email us at: mailto:inquiries@mindfulmammoth.com.

Connections to NGSS Standards

Related performance expectations	
3-LS4-3	Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
3-LS4-4	Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
MS-LS2-4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-ESS3-4	Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
HS-LS4-5	Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species ... (3) the extinction of other species.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
• Developing and Using Models • Engaging in Argument from Evidence	• LS2.C: Ecosystem Dynamics, Functioning, and Resilience • LS4.D: Biodiversity and Humans • ESS3.C: Human impacts on Earth systems	• Patterns • Cause and effect • Systems and system models • Structure and function • Stability and change

Game and Lesson Guide

Overview

Fire Tag is a high-energy educational game for ecologically curious people of all ages. Being a serious game, *Fire Tag* is also a simulation. Each round of the game is a thought experiment. By playing multiple rounds and doing multiple experiments, you (and your players) can learn specific truths about the fire ecology of central and southern California, as well as broader truths about ecosystem dynamics and human impacts on Earth's systems.

The game of *Fire Tag* is a variation on the well-known game of *Freeze Tag*. Where *Freeze Tag* has just two roles ("It", and everyone else), *Fire Tag* has four: Fire, Rain, Shrub, and Grass. Each role has a different job. Fires must chase and tag Shrubs and Grasses. Shrubs and Grasses must keep away from Fires. If tagged by Fire, they must stop and sit. Rain must work to maintain balance, delivering water to sitting Shrubs and Grasses, and restoring them to life. These mechanics form a highly-simplified, yet remarkably useful model of shrubland and grassland ecosystems in Southern California.

The lesson consists of four parts: an introduction to the game of *Fire Tag*, two rounds of *Fire Tag*, and then a short discussion. With the post-game discussion, you can highlights differences between the two rounds/experiments and discover important facts about life and ecology in the shrublands and grasslands of southern and central California.

Key lessons

- After a fire, grasses grow back much more quickly than shrubs.
- Because of this difference in growth rate, landscapes with many fires slowly change from shrubland to grassland.
- Most California shrublands are in easy driving distance of human communities and are frequently set afire in human-caused accidents.
- We careless humans with our accidental fires are slowly changing Southern California landscapes from high-diversity native shrublands to low-diversity nonnative grasslands.

Materials for Playing the Game

(for one group of 15 players. If you have more, scale accordingly)

Playing Area:

- (optional/recommended) One copy of the rules poster (free printable pdf here).
- An open space at least 20' x 20', marked out with cones, rope, or field paint.
- Stopwatch.
- Whistle (or equivalent) to start/stop the game.

The Ocean:

- One water container. Minimum 5 gallons in size. Preferably blue. Ex: bucket, inflatable-pool, etc.
- (optional) Ocean-themed bath toys. Ex: fish, crabs, whale, etc.
- Water (if you don't mind getting wet) or mater (if you do mind getting wet). "Mater" is mind water. It is exactly as wet as you think it is. If you or your players prefer not to get wet, you can easily make as much mater as you need by creating crumpled up balls of blue printer/copier paper: one crumpled blue ball = one unit of mater.

Costumes:

You can create quick and easy costumes using the FireTag_Hats.pdf file (here). Simply print the pages (as many as you need), cut out the pieces, and stick the ends together with tape or staples.

- 3 x Fire Headbands
- 3 x Rainstorm Headbands
- 10 x Shrub Headbands
- 10 x Grass Headbands
- 2 x cup or mug (preferably blue)

Discussion Aids:

- One *Results Board*. Any flat, vertical surface will do (e.g. whiteboard, wall).
- A set of result icons (free printable pdf here).
- Everyday clear tape (e.g. Scotch tape, packing tape).

Setup:

- Gather materials.
- Construct costumes. Players can be a big help with this part.
- Cut out the results icons. Players can be a big help with this as well.
- Mark out the playing area using cones/rope/paint. For a 15 player game, you'll need at a space at least 20' x 20' (400 sq. ft.). 30' x 30' is better.
- Place the 'Ocean' at one edge of the playing area. Fill your container with water/confetti, and (optionally) with ocean-themed pool/bath toys.

Introduce the Game

Outline the program for the players

- You'll give a short introduction, play two rounds of the game, then hold a post-game discussion.
- Point out that this game is a model of the real world-ecosystems of Southern California. This means that each round of the game is both a game and a live action experiment.

Explain the rules of the game

The rules poster (downloadable here) is helpful, but not necessary.

The Fire Tag *rules poster.*

Step through the rules, one-by-one. For each rule, first state the rule in words. If you have the rules poster, also point to the corresponding visual explanation of the rule in the rules poster.

Note: For rules 4-7, we strongly recommend that you find volunteers to demonstrate the rule. Players of all ages, both adults and children, have a tendency to space out during rule explanations. Ex: for rule #4, find two volunteers. Give a fire hat to one volunteer. Give a grass hat to the other volunteer. Have the Fire volunteer tag the Grass volunteer, and make the Grass volunteer sit down. Do the same for the rest of the rules.

Rules:

1. This is the only optional rule in the game. Offer players the choice to play with either *mater* or *water*.
    a. Note: If you use real water, Shrubs and Grasses may get wet, but Rain and Fire will not. If you have 1-2 people who really don't want to get wet, you can use real water but assign the hydrophobes to the Rain and Fire roles. If you have lots of people who don't want to get wet, you should use mater (crumpled blue balls of paper).
2. No biting, kicking, punching, tripping, or any other sort of mean-spiritedness.
3. Listen for the whistle. The whistle marks the end of a round. When you hear the whistle, you must stop where you are. Standing players must stay standing, while sitting players must stay sitting.
4. When a standing/moving Grass is tagged by a Fire, the Grass must stop and sit.
5. When a Rain pours ONE cup of water on a sitting grass, the Grass is restored, and may stand and move again.
6. When a standing/moving Shrub is tagged by a Fire, the Shrub must stop and sit.
7. When a Rain pours TWO cups of water on a sitting Shrub, the Shrub is restored, and may stand and move again.

Important note for mater users: It's relatively easy to cut corners when using mater. Remind players that mater is exactly as wet as they think it is, and encourage them to use their imagination to pretend it acts just like water. This means that each cup can hold exactly one unit of mater. It also means that after mater is poured out on a Grass/Shrub, it seeps into the ground, and is unavailable for reuse. Rain players may not gather dropped mater from the ground and reuse it. Rain players may only gather mater from the ocean.

Describe the end-of-round accounting

At the end of each round, every player who is sitting must stay sitting. Every player who is standing (Fire and Rain included) should then walk over to the Results Board, and under the guidance of the GM, stick a matching icon to the Results Board. Each Grass will add a grass icon; each Shrub will add a shrub icon, etc. Young players tend to like this part. Emphasizing the fact that standing players have the right to add to the Results Board provides an incentive for Shrubs and Grasses to avoid being tagged.

Outline the roles

- Emphasize the fact that each role has an important Job, with a capital 'J.'
- Fire: Tag as many players as possible. Keep as many players sitting as possible.
- Rain: Restore sitting players. Keep as many players running as possible.
- Grass/Shrub: Keep away from Fire.

Round One

Assign/distribute roles

When deciding on roles, we recommend you ask for volunteers. Start by asking, "Who feels fiery today?" Pick a volunteer, and give them a Fire hat. Continue on to solicit volunteers and assign roles to the remaining players.

Be careful with your choice of Fire! The role of Fire, like 'it' in tag, has the most physically challenging job. If possible, try to pick the most physically fit person for this role. Consider asking for people with skill in a cardio-type sport (soccer, cross country, track and field, etc.).

10-20 players: Choose one Fire, and two Rains. Then, split the remaining players evenly among Shrub and Grass. With 15 players, this comes out to one Fire, two Rains, six Shrubs, and six Grasses.
20-40 players: Choose two Fires and three Rains. Then, split the remaining players evenly among Shrub and Grass.

Costuming

Hand out costumes as appropriate. Make sure that each Rain player gets a mug.

Review roles

Note: With young players, repetition is key. This game has very few rules and lots of flexibility. Creative players can play in a way that is unrandom and produce results that are counter to the intended message. For example, we have seen Rain-type players refuse to go to the aid of a stranger, and instead hang around their friends to make sure that their friends had constant and easy access to immediate water-type support. When players adopt this sort of preferential, non-evenhanded behavior, it reduces the authenticity of the simulation, and makes it harder to grasp the intended ideas. While it's impossible eliminate this risk, you can minimize this risk by asking the players to carry out a Job with a capital 'J'.

Separate players into groups, by Job. Remind each group of their job, and make them repeat it back to you as a group.

- Fire's Job is: "To tag as many people as possible, and keep as many people sitting as possible."
- Rain's Job is: "Pour water from the Ocean on sitting players, and keep as many players standing-and-running as possible."
- Grasses' Job is: "To stay away from Fire."
- Shrubs' Job is: "To stay away from Fire."

Play Round One

Tell players that this first round will last two minutes. Send the Shrubs and Grasses into the playing area. Send the Rain(s) to the Ocean, and have them fill their mugs. Blow the whistle to begin the round. At the same time, start your stopwatch.

After two minutes, or earlier if players are flagging, blow the whistle again to end the round. All players should freeze.

Record results

Call the standing players up to the results board. Note that the board is split into two halves: top and bottom. The top half is for recording the results of this first round.

Ask the Fire(s) to step forward, pick up a fire-type icon, and tape it to the **left** side of the **top** half of the results board. Ask the Rain(s) to step forward, pick up a rain-type icon, and tape it to the **left** side of the **top** half of results board. Ask the Shrubs to step forward, pick up a shrub-type icon, and tape it to the **right** side of the **top** half results board. Finally, ask the grasses to step forward, pick up a grass-type icon, and tape it to the **right** side of the top half of the results board.

The result should look something like a chemical equation, where Fire and Rain produce some number of Shrubs and Grasses. This is the data from your first round/experiment.

Recording round one results
@IndieCade 2016

Round Two

More Fire

From among the Grasses and Shrubs, recruit volunteers to take on the role of Fire. Have the chosen players take off their Grass/Shrub hats and put on a Fire hat.

If you accept more than one volunteer, try to draw equally from the ranks of both Grasses and Shrubs.
10-20 players: Take 1-2 volunteers.
20-40 players: Take 2-3 volunteers.

Play Round Two

Just as in round one, tell players that this round will last two minutes. Send the Shrubs and Grasses into the playing area. Send the Rain(s) to the Ocean, and have them fill their mugs. Blow the whistle to begin the round. At the same time, start your stopwatch.

After two minutes, or earlier if players are flagging, blow the whistle again to end the round. All players should freeze.

Record results

As before, call the standing players up to the results board. Note again that the board is split into two halves: top and bottom. The bottom half is for recording the results from round two. Role by role - Fire, Rain, Shrub, then Grass - have players come forward, pick up an icon that matches their hat, and tape their icon to the bottom half of the results board.

The result should again look something like a chemical equation, where Fire and Rain produce some number of Shrubs and Grasses. This is the data from your second round/experiment.

Core Discussion Guide

Gather players in an arc in front of the results board. Have them sit down. Congratulate them on their gameplay skill - speed, strategy, etc. Using short, focused questions, lead the players through the results of the each round and facilitate a reflective discussion about those results. Feel free to adapt questions to your audience, as you see fit.

Reflecting on results after a game of Fire Tag at IndieCade 2016. Note the homemade results board: top half shows results from first round, bottom half shows results from second round.

Core Ecological Discussion

Q: In this game, Grasses and Shrubs don't just look different (different hats), they behave differently. How do Grasses and Shrubs behave differently after a fire?

A: When 'burned', both must sit down. But after being burned, grasses can be restored with just one cup of water, while shrubs require two cups of water.

Q: After a fire, what grows back faster, Grasses or Shrubs?

A: Grasses.

Q: So. If you have a situation where there is a lot of fire, what kind of plants will suffer the most - Grasses or Shrubs? Why?

*A: Shrubs. After a fire, shrubs need more time to grow back. If there are lots of fires, one right after another, shrubs won't have time to grow back between fires, and they will suffer quite a lot. Grasses, as they grow back quickly, *may* have time to grow back between fires, and will therefore suffer less than the shrubs.*

Punchline: Right! And this happens in real life. In California, places with frequent fires tend to be filled with grasses, while places with less frequent fires have a mix of shrubs, grasses, and other types of plants.

Q: What causes fires?

A: Lightning. Escaped campfires. Cigarettes thrown out of windows. Broken power lines. Car crashes. Plane crashes.

State the core message:
Notice that most of the things on this list are 'anthropogenic', of human origin, in one way or another caused by humans? This is a big deal. California is a populous state, with lots of humans. The fact that it has lots of humans means there are lots of opportunities for human accidents, and there are lots of human-caused fires. Many California landscapes now have far more fire than they used to, back when humans were more scarce. These frequent human-caused fires are changing many California landscapes from shrubland (high diversity) to grassland (low diversity).

We, the humans of this world, are slowly changing the landscapes of our country. Even 'natural' landscapes, places without cities or houses, are changing - because we are causing them to change. And one of the major ways we are causing change is through fire.

Core Modeling Discussion

So, let's look at the game results and see if this happened in our gaming experiments.

Bring out the results board. Point to the top half. Outline the results from round two, as recorded on the board. ex: "In round one, we had {so many} Fires, {so many} Rainstorms. At the end of the round, we had {so many} living shrubs, and {so many} living grasses."

Q: Compare the proportions of grasses and shrubs. At the end of round one, what were the relative proportions of grasses to shrubs?

A: {Varies. Possibilities include: many more grasses than shrubs, a few more grasses than shrubs, similar numbers of grasses and shrubs, a few less grasses than shrubs, many fewer grasses than shrubs. We recommend you help your players to find a broadly true answer, and focus on qualitative results rather than quantitative results.}

Point to the bottom half of the board. Outline the results from round two, as recorded on the board. ex: "In round two, we had {so many} Fires, {so many} Rainstorms. At the end of the round, we had {so many} living shrubs, and {so many} living grasses."

Q: Compare the proportions of grasses and shrubs. At the end of round one, what were the relative proportions of grasses to shrubs?

A: {Again, answers will vary. Again, we recommend you help players to find a qualitatively true answer, and avoid quantitative analysis.}

Q: Compare the results from these two rounds, these two experiments. How is the proportion of grasses:shrub in the first round/experiment different from the proportion of grasses:shrubs in the second round?

A: {Varies.}

Q: How does this result compare with what you expected?

This is the most complex part of the discussion. Remember that, when there are lots of fires, shrubs suffer more than grasses. For example, if you had equal numbers of grasses and shrubs at the end of the first round, you would expect to have more grasses than shrubs at the end of the second round.

If your results match the expected results, great! If not, great! Either way, your results set the stage for a fruitful discussion of the process of model-making.

Q: This game is a model of a real-world California landscape. In what way is this model true or accurate?

A: Shrubs and grasses exist in the landscape. After fire, grasses regenerate faster than shrubs. Rain and fire both play important roles in shaping the ecosystem. Rain clouds (in California) get their water from the ocean.

Q: In what way is this model untrue or inaccurate?

A: Shrubs and grasses can't move. The real world has trees, animals, earthquakes, etc - many more types of lifeforms and ecological forces than were in this game.

Q: How could you make this model more accurate?

A: Add more types of organisms. Add more ecological forces. Allow water to stop/slow fire. Etc.

State the core message:
A very famous scientific principle is that, "All models are wrong, but some are useful." We've described some important ways that this game/model is wrong, yet, despite being wrong, it was also useful. Not only did it teach us basic facts about these particular ecosystems, but it gave us the opportunity to practice science, and it created an opportunity for fun.

Science is a process of iterative model building. You make a model based on what you know, test out that model, and learn from the experience of testing that model. You then remake the model based on your new and better knowledge, test out that new model, learn from the experience of testing that new model, and repeat. Today, we tested out a model/game created by an ecologist, learned from that model/game, and with your ideas on how to make it better, we've outlined a new and better model - one that we could play/test on another day.