***PANCAKE ECOSYSTEM LAB***

**A TONGUE-IN-CHEEK STUDY OF ECOSYSTEMS AND PANCAKES**

**Background:** *An ecosystem is a balanced set of living and nonliving components interacting. There are systems within systems, such as an* ***ecosystem*** *of a desert—one area of the desert has water forming an oasis, one area has no water. The presence or lack of water determines the plants and animals that live in that part of the desert, but both areas are still in the* ***biome*** *of the desert* ***habitat****.*

*Stretching the point a bit—or a lot--a pancake might be considered an ecosystem. Think about it: the ingredients interact with each other to create something specific. Changes in the ingredients change the specific outcome, just as changing the amount of water changes the plants and animals residing in a desert.*

*This lab experiments with* ***quick bread*** *(pancake) ingredients, to change the “ecosystem” of the pancake (ie, changing the pancake). Have fun with it, but don’t take it too seriously!*

*Let’s analyze the ingredients of a pancake:*

***Flour****—provides structure and is the main ingredient. In an ecosystem, this would be* ***biotic*** *(comes from a plant, so it is a living organism). Let’s call it the land in a habitat of an ecosystem because land is the basis of many ecosystems, and flour is the main ingredient in every pancake.*

***Liquid****—provides moisture, which allows the flour’s protein to interact and become gluten which turns grains of flour into a structure of batter. Water, milk, or juice are kinds of liquids used in pancakes. In an ecosystem, the amount of moisture is an* ***abiotic*** *factor that helps create the habitat. Abiotic forces are outside forces (weather, pH which measures the acid level, temperature, and moisture) that change the balance of something in the ecosystem. The amount of moisture in a habitat makes a tremendous difference as to which plants and animals will live there. The amount of flour vs. the amount of liquid determines the type of pancake created.*

***Leavening agents****—makes the quick bread rise. The difference between a quick bread and a yeast bread is the leavening. Yeast is a living organism so when added to a batter of flour and liquid, the yeast must take the time to grow in order to create the rising in the bread. A quick bread uses air, steam or chemical reactions to provide the leavening: baking soda reacts with acid (like cream of tartar or lemon juice or vinegar) to create a quick rising in the batter. Baking powder is double-acting because it has baking soda and a powdered acid to provide an initial rise, then an additional reaction occurs when the batter is heated causing a second rise. The powdered acids found in baking powder, as well as lemon juice or buttermilk, are* ***limiting factors*** *for the leavening agent. The amount of acid in proportion to the amount of base (baking soda is a base) limits the amount of rise. A limiting factor in an ecosystem would be the amount of land available for a habitat.*

***Fat****—provides tenderness, richness and some flavor. Fat coats the flour. For our pancake ecosystem, we will label fat as one of the* ***decomposers*** *or* ***recyclers****—like insects or worms that change refuse into usable material. By coating the flour, fat sets the stage for the ingredients to blend together: fat alters one ingredient into a slightly different ingredient.*

***Salt****—provides flavor. Salt is nonliving (abiotic) and affects the actions of what is living when it is present. In an ecosystem, the amount of salt in the soil changes which plants can live in the area--the plants found on the Bonneville Salt Flats vs. plants on the side of a mountain stream. An argument could be made that salt is a “****predator****” in a yeast bread—because salt slows the* ***fermenting*** *of yeast. Salt would be like a garter snake controlling the mouse population in a small garden. Unfortunately, a quick bread is a “quick bread” because it does not use yeast, so salt cannot be our predator here. Salt functions in a quick bread the same way salt functions in soil: it enhances what is already there.*

***Sugar****—provides sweetness, flavor, moistness and browning. For our pretend ecosystem, we’ll put sugar in as the food which grows for the animals—like seeds for mice or berries for birds. Sugar**would be a* ***competitor*** *to some extent with the flour for the moisture.*

***Egg****—Eggs strengthen the structure of a quick bread, also providing some leavening lift if the whole egg is beaten before including it in the batter, or lots of lift if the whites are beaten to a foam and folded in. They add flavor, color and help the fat and liquid blend together. Eggs could be likened to trees and bushes that put down roots to prevent erosion of the soil. In other words, for the “ecosystem” the egg is an* ***autotroph****: it does compete for a few resources, it is a resource for other organisms to use, but it doesn’t eat something else in order to survive.*

*Other ingredients—Spices, flavorings, fruit fillings, and so forth are “extras” for a quick bread. They give the pancake individuality and creative fun. For a pancake “ecosystem,” these other ingredients are* ***species*** *of animal populations—like blackbirds and bluebirds in the bird* ***population****. It provides* ***diversity****, but has no significant impact on the ecosystem outside of the increase in population.*

*The idea behind this lab is to have the student groups take different pancake recipes, categorize each ingredient’s purpose and explain/hypothesize the “ecosystem” of their pancake. As long as the students get the food function of their ingredient correct, they can use any argument they want to support their choice of role for an ingredient in the ecosystem. The other students may judge their debate.*

*After making their pancake ecosystem, large* ***omnivore*** *predators (the students) will destroy the ecosystems by eating their pancakes.*

**Ecosystem Vocabulary:**

*Abiotic—*nonliving; a nonliving factor affects the environment of a habitat*.*

*Autotroph—*an organism that can produce its own food from nonliving matter using light

(photosynthesis) or chemical energy. Plants, algae and some bacteria are autotrophs*.*

*Biome—*an area that can be classified by the plants and animals that live there. There can be many

ecosystems in a biome.

*Biotic—*a living organism*.*

*Competitor—*Something or someone involved in competition. In biology competition is interaction in

which two organisms both need the same food or resource for survival*.*

*Decomposers—*organisms that consume the wastes of other organisms and turn them into another

resource.

*Diversity—*the number of different types of living organisms in an area.

*Ecosystem—*the interaction of living and nonliving organisms in an environment*.*

*Habitat—*the place where an organism usually lives*.*

*Limiting factor—*a resource with a finite amount that will run out before other resources do*.*

*Omnivore—*A kind of animal that eats anything, both plants and animals*.*

*Populations—*Groups of organisms that live in the same place at the same time*.*

*Predator—*An organism that preys on and eats other organisms to survive. For example, a wolf is a

predator of a deer*.*

*Species—*organisms that have common characteristics and qualities*.*

**Food ingredient function vocabulary:**

*Eggs—*Eggs bolster the structure of a flour and liquid batter. Egg whites, when beaten

provide additional lift to the batter and trap CO2  in the bubbles it creates. The

egg yolk provides protein and additional tenderness.

*Fats*—Fats can be oils, margarine, butter or a solid shortening. They contribute

tenderness, moisture, some flavor and “mouthfeel” of smoothness to the

product.

*Fermenting—*a biological reaction that creates gases that cause air pockets and rise in

yeast breads.

*Flour—*Usually made of a ground cereal grain, flour is the main ingredient in a quick

bread.

*Leavening Agents—*Something that incorporates air into a baked good. Yeast is a

leavening agent used for breads, requiring rising time for yeast to ferment and

create the air pockets in the dough structure. A Quick Bread uses leavening

agents that do not need fermentation or rising time, but rather utilize the

immediate reactions of baking soda to an acid to create air pockets in the batter,

or baking powder that has both the baking soda and an additional leavening

agent that provides rise during cooking.

*Liquid--*Liquids in a quick bread could be water, milk, juice, or any number of fluids that

add moisture to the flour. Liquids mix with the flour to form the batter of a quick

bread. If the batter is pourable, the ratio of fluids to flour is 1 to 1. The greater

the amount of liquid, the thinner the batter.

*Quick Bread—*A bread product that does not need time to rise. Their leavening agents

are typically chemical reactions between baking soda and an acid, or steam.

*Salt—*A mineral substance that enhances the flavor of foods.

*Sugar—*A sweetener in foods. Sugar adds flavor and browning to a quick bread. Sugar is

also responsible for the spreading of cookies when heated. Sugar contributes to

moisture retention and tenderness of the product.

**This lesson addresses the following USOE Core Standards:**

**Foods & Nutrition Science 1**

Standard 3, Objective 3c—Identify the role of ingredients in quick breads

**Biology**

Standard 1, Objective 3—Describe how interactions among organisms and their environment help shape ecosystems.

**Materials per group:**

1. Recipe for an international pancake

2. Ingredients for each recipe

3. Ingredient Function/Ecosystem Table to fill out

Pancake recipes and specific ingredients (*pancakes only: no fillings)*

|  |  |  |  |
| --- | --- | --- | --- |
| Buttermilk Pancakes | Crepes | German Pancakes | Serabi |
| Flour | Flour | Flour | **Rice** flour |
| Baking powder |  |  | Baking powder |
| Baking soda |  |  |  |
| Salt | Salt | Salt | Salt |
| Sugar | Sugar |  |  |
| Eggs | Eggs | Eggs | Egg |
| Buttermilk | Milk | Milk |  |
| Sour cream (or more buttermilk) |  |  |  |
| Unsalted butter | Butter | Butter or margarine |  |
|  | Vanilla Extract |  |  |
|  |  |  | Coconut milk (light) |
|  |  |  | Water |

Ingredients for fillings or toppings: (*if used)*

|  |  |  |  |
| --- | --- | --- | --- |
| Buttermilk Pancakes | Crepes | German Pancakes | Serabi |
| Maple Syrup | Strawberries | Butter or margarine | Coconut milk (light) |
|  | Orange Juice Concentrate | Brown sugar | **Coconut** sugar (or other kind of sugar) |
|  | Sugar | Cinnamon | Granulated sugar |
|  | Whipping Cream | Nutmeg | Salt |
|  |  | Powdered sugar | Pandan leaf (optional) |
|  |  | Apples | Bananas or apples |

**Instructions** *(with teacher notes)***:**

*To the teacher: for more information on ingredient functions, go to*

<http://www.foodworks-intl.com/page47_baking_ingredients_function.htm>

1. Lab groups should be divided so that at least three types of pancakes are being made within the class. *These recipes include fillings or toppings that you may not want to do in class. Choices are: (1) All American Buttermilk Pancake, (2) French Crepe, (3) apfelpfannkuchen—Baked German Apple Pancake, or (4) Serabi—Indonesian rice flour and coconut pancake—this is a gluten-free option (remember to use gluten free baking powder, too)*

2. Fill out the Food Function/Ecosystem Role table as they make their pancake recipe.

Using the definitions found in the ecosystem vocabulary list, and your knowledge of ingredient functions, choose an ecosystem role for each ingredient in your pancake. Be prepared to defend your position to the class.

**Discussion Points/Questions:** *(With teacher notes)*

|  |  |  |
| --- | --- | --- |
| **Food Function** | **Ingredient** *List specific ingredient* | **Ecosystem Role** |
| *Main ingredient—forms structure as the proteins in the flour interact with the liquid to form gluten strands. Rice flour does not form gluten.* | **Flour** | *Land, the basic resource for the habitat* |
| *Provides moisture—interacts with flour to create structure* | **Liquid** | *Abiotic factor—a factor that is nonliving, but affects what lives in the ecosystem* |
| *Creates bubbles in the batter structure providing lift to the quick bread* | **Leavening Agent** | *Biotic or abiotic limiting factors that change the ecosystem because they run out before the other resources do.* |
| *Enhances flavor* | **Salt** | *Determines the type of plant or animal that lives in the ecosystem—some organisms prefer more salt than others* |
| *Sweetens, adds flavor and tenderness, moisture, usually contributes to browning* | **Sugar** | *Food for the organisms living in the ecosystem or habitat* |
| *Contributes some flavor and moistness, tenderness, and a smooth mouthfeel* | **Fat** | *Decomposer or recycler because it takes something and alters the structure to create something else. Decomposers eat the refuse left over from some other organism, then turn it into a new organism for use again.* |
| *Strengthens the structure of the batter by the blending (emulsification) of the fat and liquid, adds some leavening if beaten first.* | **Egg** | *An autotroph. Plants are autotrophs: Plants don’t take away food from animals, they make their own food through photosynthesis, and they prevent erosion. An egg doesn’t have to be in a pancake, but if it is, it will strengthen the batter and bind it together without taking away from anything else.* |
| *Sour cream and buttermilk add acid to react with the baking soda and baking powder to give extra leavening and flavor in the buttermilk pancakes.* | **Other** | *Other components to ecosystems create diversity in the populations, which some scientists feel creates a more stable ecosystem. Arguments may be made that some ingredients compete with each other, or even prey upon each other. (If onion is added to a pancake it certainly would overpower the other flavors) The students will have to make up their own minds on any of these ingredients, but especially the “other” category. By debating and defending their choices, they will of necessity also learn the functions of the ingredients and the parts of the ecosystems.* |
| *Extracts like vanilla or other spices add flavor and individuality to the pancake* | **Other** |  |
| *Coconut or fruit additions also add flavor and individuality to the pancake* | **Other** |  |

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*The main* ***predators*** *in our pancake ecosystem are the large* ***omnivores*** *who eat the pancakes once they are made.*

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**Materials per group:**

1. Recipe for an international pancake

2. Ingredients for each recipe

3. Ingredient Function/Ecosystem Table to fill out

**Discussion Points/Questions:**

Using the definitions found in the ecosystem vocabulary list, and your knowledge of ingredient functions, choose an ecosystem role for each ingredient in your pancake. Be prepared to defend your position to the class.

|  |  |  |
| --- | --- | --- |
| **Food Function** | **Ingredient** *List specific ingredient* | **Ecosystem Role** |
|  | **Flour** |  |
|  | **Liquid** |  |
|  | **Leavening Agent** |  |
|  | **Salt** |  |
|  | **Sugar** |  |
|  | **Fat** |  |
|  | **Eggs** |  |
|  | **Other** |  |
|  | **Other** |  |
|  | **Other** |  |

Adapted from [Serious Eats - seriouseats.com](http://www.seriouseats.com/)

[THE FOOD LAB](http://www.seriouseats.com/recipes/columns/the_food_lab/index.html)

*Unraveling the mysteries of home cooking through science.*

**Light and Fluffy Buttermilk Pancakes**

[**J. Kenji López-Alt**](http://www.seriouseats.com/user/profile/Goodeaterkenji) MANAGING CULINARY DIRECTOR

About This Recipe

|  |  |
| --- | --- |
| YIELD: | 8 pancakes |
| ACTIVE TIME: | 30 minutes |
| TOTAL TIME: | 30 minutes |

Dry Ingredients:

1 cup flour

1/2 teaspoon baking powder

1/4 teaspoon baking soda

1/2 teaspoon kosher salt

1-1/2 teaspoons sugar

Wet Ingredients:

1 large egg, separated

3/4 cup buttermilk

1/2 cup sour cream

2 Tablespoons of unsalted butter, melted

Procedures:

1. Combine flour, baking powder, baking soda, salt, and sugar in a medium bowl and whisk until homogenous.

2. In another medium bowl, whisk the egg whites until stiff peaks form. In a large bowl, whisk the egg yolks, buttermilk, and sour cream until homogenous. Slowly drizzle in the melted butter while whisking. Carefully fold in the egg whites with a rubber spatula until just combined.

3. Pour the wet mixture over the dry mix and fold until just combined (there should still be plenty of lumps).

4. Heat a large heavy-bottomed nonstick skillet over medium heat for 5 minutes (or use an electric griddle). Add a small amount of butter or oil to the griddle and spread with a paper towel until no visible butter or oil remains. Use a 1⁄4-cup dry measure to place 4 pancakes in the skillet and cook until bubbles start to appear on top and the bottoms are golden brown, about 2 minutes. Carefully flip the pancakes and cook on the second side until golden brown and completely set, about 2 minutes longer. Serve the pancakes immediately.

[](http://www.seriouseats.com/user/profile/Goodeaterkenji)

ABOUT THE AUTHOR

[**J. Kenji López-Alt**](http://www.seriouseats.com/user/profile/Goodeaterkenji) MANAGING CULINARY DIRECTOR

*J. Kenji López-Alt is the Managing Culinary Director of Serious Eats, and author of the James Beard Award-nominated column*[*The Food Lab*](http://www.seriouseats.com/the-food-lab/)*, where he unravels the science of home cooking. A restaurant-trained chef and former Editor at Cook's Illustrated magazine, he is the author of upcoming The Food Lab: Better Home Cooking Through Science, to be released on September 21st, 2015 by W. W. Norton.*

apfelpfannkuchen - german apple pancake [http://www.recipe.com/apfelpfannkuchen-german-apple-pancake/](http://www.recipe.com/apfelpfannkuchen-german-apple-pancake/%20)

Recipe from [Better Homes and Gardens](http://www.bhg.com/recipes/)

**SERVINGS:** 6

**PREP TIME:** 10 mins

**BAKING TIME**: 18 to 20 mins

* 3 eggs
* 1/2 cup all-purpose flour
* 1/2 cup milk
* 2 tablespoons margarine or butter, melted
* 1/4 teaspoon salt

FILLING:

* 2 tablespoons margarine or butter
* 1/3 cup packed brown sugar
* 2 medium cooking [appleshttp://images.intellitxt.com/ast/adTypes/icon1.png](http://www.recipe.com/apfelpfannkuchen-german-apple-pancake/), peeled, cored, and thinly sliced (2 cups)
* 1/4 teaspoon ground cinnamon
* 1/4 teaspoon ground nutmeg
* Sifted powdered sugar

**directions**

**1.**

In a medium [mixing bowl](http://www.recipe.com/how-to/colorful-mixing-bowls-under-50/) beat eggs with a wire whisk until frothy. Add [flour](http://www.bhg.com/shop/food/pantry-items/baking-ingredients/flour-c5476.html), milk, 1 tablespoon of the melted margarine or butter, and salt; beat until smooth.

**2.**

Heat an 8-inch round [baking pan](http://www.bhg.com/shop/kitchen/bakeware/baking-pans-a3040.html) or ovenproof [skillet](http://www.bhg.com/shop/kitchen/cookware/frying-pans-and-skillets-a2557.html) in a 450 degree F oven for 2 minutes. Add remaining 1 tablespoon melted margarine; swirl to coat pan. Pour batter into hot pan. Bake pancake in the 450 degree F oven for 18 to 20 minutes or until puffed and golden.

**3.**

Meanwhile, for filling, in a medium skillet melt the 2 tablespoons margarine or butter over medium heat. Stir in [brown sugarhttp://images.intellitxt.com/ast/adTypes/icon1.png](http://www.recipe.com/apfelpfannkuchen-german-apple-pancake/) until combined. Stir in apple slices, cinnamon, and nutmeg. Cook, uncovered, for 3 to 5 minutes or until apples are crisp-tender, stirring occasionally.

**4.**

To serve, remove pancake from oven. Spoon some of the filling into center of pancake. Sprinkle with powdered sugar. Cut into wedges. Pass the remaining filling. Pancake will collapse as it cools. Makes 6 servings.

**NUTRITION INFORMATION**

Per Serving: cal. (kcal) 217, Fat, total (g) 11, chol. (mg) 108, sat. fat (g) 3, carb. (g)26, fiber (g) 1, pro. (g) 5, vit. A (IU) 729, vit. C (mg) 2, sodium (mg) 223, calcium (mg) 40, iron (mg) 1, Percent Daily Values are based on a 2,000 calorie diet

Adapted from [Serious Eats - seriouseats.com](http://www.seriouseats.com/)

**Crepes with Strawberries & Cream**

  About This Recipe

|  |  |
| --- | --- |
| YIELD: | Serves 4 |
| ACTIVE TIME: | 25 minutes |
| TOTAL TIME: | 25 minutes |
| SPECIAL EQUIPMENT: | 10 inch nonstick skillet |
|  |  |

**Ingredients**

* **For the Crepes:**
* 2 eggs, beaten
* 1 cup milk
* 1/4 teaspoon vanilla extract
* 4 tablespoons melted butter, divided
* 1 cup (5 ounces) all purpose flour
* Pinch of salt
* 1 tablespoon sugar
* **For the Strawberries and Cream:**
* 1 1/2 pounds (24 ounces) strawberries, quartered
* 2 Tablespoons unsweetened orange juice concentrate
* 1 tablespoon sugar (for strawberries)
* 1 cup (1/2 pint) whipping cream
* 1 tablespoon sugar (for cream)

**Procedures:**

**1. For the Strawberries and Cream:** Combine cream and sugar in a large bowl. Using a hand blender or a whisk, whisk cream and sugar together until cream reaches stiff peaks. Cover and keep cool in the fridge.

**2.** Place strawberries, sugar, and orange juice concentrate in a bowl, toss so the strawberries are coated, then allow to sit on the counter while you assemble the crepes.

**3. For the Crepes:** Whisk together eggs, milk, vanilla, and 2 tablespoons melted butter. In a separate bowl whisk together flour, a pinch of salt, and sugar. Whisk wet ingredients into dry ingredients until no lumps remain.

4. Using a heat-proof pastry brush, brush a 10-inch nonstick skillet with butter, then heat over heat until the butter begins to sputter. Add just under 1/4 cup of batter to the pan, then swirl the pan until the batter coats as much of the bottom of the pan as possible. Cook until batter begins to brown, about 1 minute. Using a rubber spatula, flip the crepe and cook until the other side is brown, about 1 minute. Remove from pan and repeat with remaining batter.

5. Place 2 to 3 crepes on each plate and divide strawberries and a dollop of cream. Fold crepe in half and serve.

[](http://www.seriouseats.com/user/profile/sydneyoland)

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Adapted from <http://www.food.com/recipe/serabi-425282>

SERABI

*This is one of my childhood favourites and a traditional Indonesian dish. It is eaten as a snack or generally for afternoon tea and not usually as a dessert. Serabi is like a pancake but only cooked on 1 side. I have modified it by adding the fruit so you could also serve it for brunch/breakfast. They are traditionally cooked in an earthenware pan but a standard fry pan is fine. Try and find light coconut milk.*

INGREDIENTS

SERVINGS 4UNITS US

* 150g rice [flour](http://www.food.com/about/flour-64)—2/3 cup
* 1 teaspoon [baking powder](http://www.food.com/about/baking-powder-6)
* 1 [egg](http://www.food.com/about/egg-142)
* 1/4 teaspoon salt
* 200ml [coconut milk](http://www.food.com/about/coconut-milk-or-cream-145), light—3/4 cup
* 100ml [water](http://www.food.com/about/water-459)—2/3 cup
* Sauce
* 250ml [coconut milk](http://www.food.com/about/coconut-milk-or-cream-145), light – 1 cup
* 50g coconut sugar – 1/4 cup (*note! Table sugar can be substituted)*
* 1 teaspoon [sugar](http://www.food.com/about/sugar-139)
* 1/8 teaspoon [salt](http://www.food.com/about/salt-359)
* 1 [pandan leaf](http://www.food.com/about/screwpine-leaves-837) (optional)
* 2 [bananas](http://www.food.com/about/banana-61), peeled and sliced
* Or 2 [apples](http://www.food.com/about/apple-186), sliced

DIRECTIONS

1. Mix the coconut milk, water, salt and egg together.
2. Add the sifted flour and baking powder and mix through the wet ingredients. Set aside while you make the sauce.
3. Place all the ingredients except the fruit into a pan and heat until the coconut sugar is melted. Add the sliced fruit and cook for about 5 minutes.
4. Heat a fry pan and spray with oil. Traditionally serabi is made small, about 2 tbsp of batter per cake but you can make them larger. Cook like a pancake but on LOW HEAT and cook on 1 side only, do not turn the cake.
5. The top should be covered in little holes.
6. Remove from heat. To serve spoon some sauce into a shallow bowl and then place the serabi on top so they float.

<http://www.food.com/recipe/serabi-425282>