Amazopoly a game of survival in a tropical rain forest

Michael William Morris

Follow this and additional works at: https://scholarworks.lib.csusb.edu/etd-project

Part of the Environmental Education Commons, Instructional Media Design Commons, and the Natural Resources and Conservation Commons

Recommended Citation
https://scholarworks.lib.csusb.edu/etd-project/34

This Thesis is brought to you for free and open access by the John M. Pfau Library at CSUSB ScholarWorks. It has been accepted for inclusion in Theses Digitization Project by an authorized administrator of CSUSB ScholarWorks. For more information, please contact scholarworks@csusb.edu.
AMAZOPOLY:
A GAME OF SURVIVAL IN A TROPICAL RAIN FOREST

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education: Environmental Option

by
Michael William Morris
March 1996
AMAZOPOLY:
A GAME OF SURVIVAL IN A TROPICAL RAINFOREST

A Project
Presented to the
Faculty of
California State University,
San Bernardino

by
Michael William Morris
March 1996
Approved by:

Darleen Stoner, First Reader
Jeffery Hackel, Second Reader

March 14, 1996
ABSTRACT

Through research, games have been shown to be an effective teaching device. This master's degree project utilizes a board game as an educational tool designed to teach about tropical rain forests.
ACKNOWLEDGEMENTS

I would like to thank my parents William and Peggy Morris, Dr. Darleen
Stoner, Dr. Jeffery Hackel, Judith and Ed Ellsworth, Jerry Garcia, Kay
Phillipson, Trish Misenheimer, Dr. Kenneth Johns, and Dave Martell for their
unfaltering and limitless support.
TABLE OF CONTENTS

ABSTRACT .................................................. iii
ACKNOWLEDGMENTS ....................................... iv
INTRODUCTION ........................................... 1
LITERATURE REVIEW
    Constructivism and How Children Learn ............. 3
    Gaming Simulations and Learning ................... 4
PROJECT DESIGN .......................................... 10
RESULTS AND DISCUSSION ............................... 11
IMPLICATIONS FOR EDUCATORS ......................... 13
APPENDIX: AMAZOPOLY Game ............................ 14
REFERENCES .............................................. 42
INTRODUCTION

There has been much discussion about the condition of the Earth and its inhabitants. This topic is not new by any means; historically, humankind has always been concerned with its survival, which was dependent on a healthy and productive environment. Currently, in this age of increasing populations and limited resources, environmental education is needed more now than ever before.

Tropical rain forests have several attributes that make them very important to learn about. First, they have a high amount of species diversity. Second, they may contain many plants useful to humans for medicines and foods. Third, tropical rain forests are home to numerous indigenous people. Fourth, tropical rain forests play a very important role in global weather patterns and in the greenhouse effect. Lastly, when considered on a purely aesthetic level, tropical rain forests offer a pleasing and wondrous sight.

However, the rate at which this ecosystem is being destroyed by humans is alarming. We are in a race against time. The magnitude of the loss of tropical rain forests forces us to take action before they are all gone. Educating the citizens of the world, especially young people, about the importance of tropical rain
forests is a start to ultimately treating them in a sustainable fashion. Only after ignorance is removed can change begin to take place.

This master's degree project was designed to help people learn about tropical rain forests in an enjoyable manner. It consists of a board game about tropical rain forests called AMAZOPOLY (a complete description is found in the appendix), and a literature review which encompasses constructivism and gaming simulations and learning. The concepts that the literature review yielded justify using a game format and serve as the basis of why a game would be effective as a teaching tool.
LITERATURE REVIEW

Constructivism and How Children Learn

A discussion of constructivism is included in this master’s degree project because it serves as the basic foundation on which AMAZOPOLY was built. Constructivism maintains that knowledge is not passively acquired; it is generated when individuals encounter new information and compare it to what they already know. Any discrepancies arising between prior knowledge and new information force evaluation and possibly revision of the prior knowledge. Thus, new knowledge is created when individuals integrate new ideas into their existing structures of knowledge (Klein & Merritt, 1994; Brooks, 1990).

Two California publications, Science Framework for California Public Schools Kindergarten through Grade Twelve (1990) and It’s Elementary (1992) are based on the constructivism approach to learning. The former offered many suggestions on the maintenance of a quality science program. It insisted that students learning science should be actively engaged in learning, which entails having students be actively involved in learning the major ideas in science. It also stated that a quality science program allows students to both enjoy learning science and to develop an interest and respect for
protecting the environment. It also asserted that instructional programs should be organized around themes.

It's Elementary (1992) is the report of the Elementary Grades Task Force, which was convened by the California State Superintendent of Public Instruction. Similarly, it concluded that modern cognitive research has found children learn best when they are afforded the opportunity to actively incorporate what they are studying into their own experiences, concepts, and understanding of how the world works.

AMAZOPOLY, by its design, embraces these tenets of constructivism. It involves students generating knowledge about tropical rain forests by comparing new information with what they already know. Also, players of the game are actively involved in an enjoyable, meaningful, and interesting endeavor.

Gaming Simulations and Learning

There has been much written on gaming as an effective vehicle for education and intellectual development. However, findings differ widely, probably because a correlation between these has not been consistently found (Hounshell & Trollinger, 1977). Also, despite the large amount of material written on this subject, there have been
relatively very few research studies dealing with empirical data conducted on the educational effectiveness of games (Butler, Markulis, & Strang, 1988; Jolicoeur & Berger, 1988; Randel et al., 1992).

There have been many studies that have shown that games are superior to conventional methods of teaching. These have been conducted on children of all ages, and have dealt with academic subjects in all areas, including mathematics, science, and language arts (Allen, et al., 1978; DeVries & Slavin, 1976; Heitzmann, 1974; McKeackie, 1986; Spraggins & Rowsey, 1986; Sprengel, 1994; Watkins, 1986; Weusi-Puryear, 1975; White, 1984).

However, there have also been many studies that question the advantages gaming has over traditional methods of teaching, and these have also dealt with various subjects and age groups. All authors concurred that games were shown to be no more effective than non-gaming teaching methods (Cohen & Bradley, 1978; Fraas, 1980; Pierfy, 1977; Raghavan & Katz, 1980; Spivey, 1985; Szafran & Mandolini, 1980).

There have also been some summaries written on research studies done on this topic. Magney (1990) summarized research on this subject and asserted that students playing games are no more likely to learn more than students taught by traditional methods.
Similarly, Randel et al. (1992) did a literature review on 68 studies conducted between 1963 and 1991 that made use of empirical data and examined them on the difference between games and conventional instruction in student performance. They discerned from this research that 56 percent of the studies reviewed found no difference, 32 percent favored games, 7 percent favored games but had questionable control groups, and 5 percent favored conventional instruction.

Obviously, there is a difference of opinion on the effectiveness of games and learning. While many espouse the use of games in a classroom, there is some disagreement as to just how effective gaming may be for developing the cognitive domain. However, it is clear that games are at least as effective as other modes of teaching in this regard and therefore are a legitimate teaching method.

There are many other aspects regarding games and their use in an educational setting that must be considered also. Another extremely important idea involving educational games is their positive effect on the affective domain, which involves attitudes and feelings. Cohen (1969) concluded that 87 percent of junior high students said that games were more interesting than traditional methods of teaching. Heitzmann (1974) claimed that educational
games are excellent motivators, especially to students classified as underachievers, inner city, and “disadvantaged” (culturally different). In fact, he reported that when games were being used in a seventh-grade classroom, absences decreased by 17 percent. Taylor (1985) asserted that this increased motivation that gaming seems to elicit may possibly stem from heightened interest among students in the teaching and learning process. Magney (1990) suggested that games are superior to conventional teaching methods in that they foster higher levels of student interest and promote positive attitudes toward the subject matter. Similarly, Randel et al. (1992) confirmed this in their literature review of the studies that involved gaming simulations. They maintained that 12 of the 14 studies they reviewed which measured student interest showed that students reported more interest in gaming activities than in regular classroom instruction.

The positive effect games seem to have on students’ motivation and interest in itself could make a good argument for justifying their use in the classroom. If student apathy could be minimized, perhaps they would begin to take a more active role in their learning.

There are also two other minor implications that literature on the use of games and learning supports. The first is related to the
value of play. Heitzmann (1974) stated that there is a general support among educators and developmental psychologists for the position that play contributes to one's intellectual growth, imagination, and creativity, and renowned psychologists such as Millie Almy, Bruno Bettelheim, and Jean Piaget all espoused this. One study even showed a positive correlation between divergent thinking and playfulness (Heitzmann, 1974).

The second minor implication is that the use of educational games may change the dynamics of the classroom. Heyman (1975) asserted that teachers utilizing gaming simulations are setting up a scenario for student-centered learning that the students view as "fun." Games affect the atmosphere of the learning environment in a very positive way, and their use removes the traditional student-teacher polarization, thus creating a non-authoritarian atmosphere (Taylor, 1985; Magney, 1990).

Also, use of games in a classroom may positively affect the interactions between the students; some researchers concluded that students develop the ability to work together through experiences in group interaction (Heitzmann, 1974; Magney, 1990; Wynne, 1994). Thus, games seem to allow for more student involvement in the learning process compared to more traditional methods of teaching (Taylor, 1985).
Research supports the conclusion that games have a place in our schools. Although research on particular aspects of using games in the classroom is inconsistent, review of this research shows they are at least as effective as more traditional methods of instruction. They are significant forms of experiential learning, and are often very powerful triggers to many different kinds of learning (Thatcher, 1990). Gaming can motivate and actively involve students in learning, encourage group cooperation, stimulate enthusiasm for learning, and inject realism into the classroom situation (Heitzmann, 1974).
PROJECT DESIGN

AMAZOPOLY's goal is to introduce students to important characteristics of tropical rain forests. It has the players acting as scientists traveling from a drop-off point to a local village by foot so that they may learn the secrets of the rain forest with which the natives were already familiar. Along the way, players see plants and animals, and experience conditions of the Amazon.
RESULTS AND DISCUSSION

The last step in developing my game was having my students field test it, and this was done on two occasions. Each time I chose six average to above-average fourth- and fifth-grade students, and invited them to a private party during lunchtime to try out the game. I limited the participants to this number for each game because AMAZOPOLY is only intended for two to six players. During the games I kept my interactions with them to a minimum, but I was there to answer any questions that arose. I also took notes on any problem areas of the game, so I could change them in my final revision. Everything seemed to run very smoothly, with the students remaining attentive to the game. They appeared to be enthusiastic and interested in the game.

Both games took about 50 minutes to complete, and most of the players were in contention to win until the very end of the games. Thus, I think AMAZOPOLY is effective in that it held the students' attention. Some oral comments received from the players demonstrating this were, “I liked it . . . challenging and exciting”; “fun . . . learned a lot about tropical rain forest animals”; “really fun . . . really neat . . . makes you experience tropical rain forests . . . teaches about animals”; and “lots of fun . . . lots of excitement.”
Thus, I feel that this game could be an effective vehicle to motivate the students to learn more about tropical rain forests.
IMPLICATIONS FOR EDUCATORS

AMAZOPOLY is effective as a tool to teach about tropical rain forests; it excites the children and increases their interest in the subject. However, the subject of tropical rain forests is extremely complex and encompasses much information, and AMAZOPOLY can not cover everything. Thus, this game would be best used as a supplemental rather than primary mode of teaching. Lastly, although AMAZOPOLY was originally designed for students at the elementary level, students at the middle and high school levels might also enjoy it.
APPENDIX

AMAZOPOLY:
A game of survival in a tropical rain forest

Introduction

You are one of several scientists who are trying to get to a local tribal village to learn the secrets of the rain forest from the people who live there. The players have been dropped off by a boat that can not continue any further up the river because the river has become too shallow. Thus, they must make their way on foot through the wild and mysterious jungle. The first player that safely reaches the village wins the game. However, all must proceed with extreme caution; many surprises and pitfalls await those who attempt the journey!

Number of Players:

Two to six players may play.

Game Materials:

The game board, a pair of dice, six playing tokens of different colors, a “River Roll” chart, and one deck each of “Fate” and
“Encounter” cards are provided.

Setting up the Game:

Shuffle the cards marked “Animal Encounter” and “Fate” and place them face down in separate piles on the game board. Sit around the game board, choose a colored playing token, and place it on the drop-off point.

Starting the Game:

Each player rolls one die to see who goes first. The person with the highest number rolled goes first (If two players roll the same highest number, they both roll again.) The game is begun by the player who rolls the highest number. The order of the other players is determined by order of seating in a clockwise fashion.

Moving the Players:

Players roll one or two dice and move that number of spaces on the game board. If you land on a blank space, you stay there and your turn is completed. However, if the space where you land has directions on it, you must follow the directions. Some spaces will have a letter code written on them as follows:

AE = Animal Encounter
RR = River Roll

If you land on a “F” (Fate) or “AE” (Animal Encounter) space, you must take the top card from the deck, read the information aloud, and follow the game directions. If you land on a space marked with an “RR” (River Roll), you must roll two dice and multiply the two numbers together. Find the resulting number on the River Roll chart. The directions for the number must be read aloud and followed.

***NOTE***
Your turn is completed after landing on a blank movement space or after following written directions on a movement space, Animal Encounter card, Fate card, or the River Roll chart. For example, if you move ahead two spaces because of the directions on a Fate card, and this puts you on a River Roll spot, you do not do the River Roll because you have already followed written directions for that turn. Instead, you pass the dice to the next player.

Shortcuts:
There is a shortcut along the way. It may look quicker than the long way, but you should be aware that choosing this route may take
you longer.

**Winning the Game**

Whoever reaches the village first wins the game. You must enter the village on an exact roll. If you roll of the dice is greater than the number of spaces needed to reach the village, you must remain in that spot and pass the dice on to the next player.

GOOD LUCK!!!!!!

**General Information on Tropical Rain Forests**

Tropical rain forests straddle the earth's equator, bordered on the south by the Tropic of Capricorn and on the north by the Topic of Cancer. In 1991, tropical rain forests covered six percent of the Earth’s land area, with intact forest located in Central and South America, west-central Africa, Southeast Asia, The Caribbean, on Pacific islands (including Hawaii), Australia, India, Sri Lanka, and Madagascar (Richardson, 1991). These rain forests grow in over 50 countries, with over half of their total area found in just three: Brazil with 33 percent, and Indonesia and Zaire with 10 percent each, according to the National Wildlife Federation (NWF) (1992, p.
Because of the nature of their location, tropical rain forests were minimally affected by the last Ice Age and thus have had much time to evolve. In fact, they are the Earth's oldest continuous ecosystems (Richardson, 1991). Their locale also allows for very stable conditions: Yearly temperatures average 76 degrees Fahrenheit (23 degrees Centigrade); humidity constantly remains about 70 percent; and annual rainfall exceeds at least 80 inches (2.03 meters) annually. This stability allows tropical rain forest plants to thrive throughout the year without experiencing any dormant periods due to seasonal variation; there are no winters or summers, only wet and dry seasons.

Tropical rain forests are generally classified into vertical layers to simplify discussion. The layer above the floor is the understory, composed of small trees and shrubs competing for light. Above this is the canopy layer, which contains the tops of the shortest trees and the trunks of the larger ones. When viewed from the air, this layer looks like a giant carpet of green. The canopy may reach a height of 200-300 feet (60.96-91.44 meters) overhead (that's as high as 20 classrooms stacked on top of each other!). Most of the animals in the tropical rain forest are found here. The tallest trees, known as emergents, tower above the canopy.
Because of the large amount of vegetation overhead that blocks out much of the sunlight, the ground level of a tropical rain forest is very dark. Due to this lack of light, young plants have a very difficult time growing there. Also, the forest floor is largely free from leaf litter because the conditions allow for extremely rapid decay of dead organism. This is the reason why the soils of tropical rain forests are so nutrient-poor; the decayed matter is quickly assimilated back into the plants. That is why tropical rain forest trees shallowly spread their roots out rather than send them down into nutrient-poor soil.

The amount of biodiversity in tropical rain forests is truly astounding. They are home to about half of the Earth’s five to ten million plant and animal species. They support 90,000 of the world’s 250,000 identified plant species, and it is estimated that there are at least 30,000 species yet to be identified (mostly located in tropical rain forests). A typical four-square mile patch (10,356,180 square meters) of tropical rain forest contains as many as 1500 species of flowering plants, 750 species of trees, 125 mammal species, 400 species of birds, 100 reptile species, 60 amphibian species, and 150 different species of butterflies. In one study, analysis of one square meter of leaf litter turned up 50 species of ants alone! (Rainforest Action Network [RAN] FACT SHEET
It is extremely important to note that plant and animal species in tropical rain forests have evolved into filling highly specialized niches in response to intense competition for limited resources (Richardson, 1991). This interdependency of organism means that if one species is affected by something, the effect could reach other species, thus creating a possible domino effect.

This vast speciation is very important for many reasons. Perhaps most important is the fact that we presently derive one-fourth of our medicines today from plants. Although fewer than one percent of all the plants there have been thoroughly tested for their chemical compounds, tropical rain forests have already yielded medicines used to treat childhood leukemia, Hodgkin’s disease, heart ailments, hypertension, and arthritis (just to name a few).

Tropical rain forests also are extremely important in that many foods we eat today originated there. These include avocado, banana, black pepper, Brazil nuts, cayenne pepper, casava/manioc, cashews, chocolate/cocoa, cinnamon, cloves, coconut, coffee, cola, corn/maize, eggplant, fig, ginger, guava, herbal tea ingredients (hibiscus flowers, orange flowers and peel, lemon grass), jalapeno, lemon, orange, papaya, paprika, peanut, pineapple, potato, rice vanilla, and yam (Mexican). Wild strains of these plants contribute
genetic material, which is essential in preserving our current agricultural stock (Caufield, 1991). Tropical rain forest also provide us with many other products, including rattan, rubber, gasoline substitutes, fruits, nuts, and oils.

Tropical rain forests are also important because they affect global weather patterns, help reduce erosion, and hold vast reserves of carbon dioxide in their vegetation. When trees contained in tropical rain forests are burned to clear the land for farmland, large amounts of carbon dioxide are released. This is the second largest factor contributing to the greenhouse effect (Caufield, 1991).

Another important treasure tropical rain forests hold is the people who live there. It is estimated that there are about 50 million people currently making their home there (NWF, 1992). These are the people who understand many of the intricacies of their home, and if their tribal lands are not protected, their secrets will disappear as they do.

In spite of all they have to offer, tropical rain forests are being destroyed at an alarming rate. World wide, 145 acres (60 hectares) are being destroyed per minute and 76 million acres (31,666,666 hectares) (and area larger than Italy) are being destroyed every year (Myers, 1989). Scientists believe that 137 species become extinct every day (Wilson, 1992).
The reasons for this destruction revolve around economics. The World Bank estimates that of the 2.5 billion people who live in the tropics, one billion live in absolute poverty, many of which are driven to the country to try to eek out a living through subsistence farming (RAN, 1993). Activities such as logging, mining, oil drilling and clearing land for large cattle ranches are all primary threats to these forests (RAN, 1993).

Current utilization of tropical rain forests might seem very ironic when considered on a purely economic bases. One hectare in the Peruvian Amazon has a projected economic value of $6,820 if intact forest is sustainably harvested for fruits, latex, and timber; $1,000 if clear-cut for unsustainably harvested commercial timber; or $148 if used as cattle pasture (Peters, 1989). Also, it is important to reiterate how infertile tropical rain forest soils are; after being cleared, they can sustain agriculture for only five years or so, and then will become bare.

In response to this destruction of tropical rain forests on a global level, numerous organizations have helped preserve them. The Rainforest Action Network (450 Sansome, Suite 700, San Francisco, CA 94111) and the National Wildlife Federation (14000 Sixteenth Street NW, Washington, DC, 20036-2266) are just two of these groups working on saving tropical rain forests. They are excellent
sources of information for those who wish to learn more or to get more involved.

Fate Cards

You spot a beautiful waterfall. Stay here to get a picture.

Stop here to watch a seed from a kapok tree float by you. Kapok trees may grow to be 200 feet high. Their seeds look like giant cotton balls.

Lightning strikes very close to you! Stay here two turns until the storm passes.

Stop here to get a photo of an incredible purple and yellow orchid flower. Many orchids have patterns that are visible to humans only in ultraviolet light.

You spot the beautiful bright yellow bloom of Potalia amara. Lose one turn to get a sample of this plant that is used to cure the bites of some snakes.
Stay here one turn to admire a large stand of very tall bamboo near you. The bamboo must be 100 feet tall!

Stop here two turns to rest because the heat and humidity are really starting to bother you.

Stop here to get a picture of a Madera negra. This unusual tree produces a poison that stops most insects from eating its leaves.

You are okay, but lose one turn to recover from the shock of a huge tree crashing down about 40 yards away from you.

Stop here to examine a tree that is being tapped for its latex. (This does not harm the tree.) Latex is processed into rubber.

Lose one turn here to make your way through the many vines that are covering the path. Some vines in the rain forest can grow as much as three feet in one day!

Stop here to check out a patch of land that has been used as a small farm by local people. If it is left alone for a few years, the forest will grow back.
Ouch!!! You just tripped on the roots of a tree and cut your knee. Stop here so you can clean yourself up.

Stop here to get a sample of a sabugueiro plant. Local people make it into a tea that is used to treat smallpox.

Lose one turn here to gather some Brazil nuts from the forest floor. Brazil nut trees will grow only in tropical rain forests.

Stay here to get a picture of a tree covered with epiphytes. These are plants that grow on trees instead on on the ground. Incredible as it may seem, their roots never touch soil!

Stop here to get a sample from an Amor crescido plant. Some local people here rub this plant on their scalps to help stop hair loss.

You spot a snake plant. Stop here to take notes and get a sample of it. The local people use it to treat bites from many insects and snakes.

You spot a canarana plant near you. Stop to take a sample of it. It is used by some locals to treat many kidney and urinary problems.
Stop here to get a sample of an Aristolochia vine, which is made into a tea by the local people and used to relieve stomach aches.

Lose one turn to take notes on and photographs of a copaiba tree. This very unusual tree produces a sap very similar to diesel fuel. It can be poured directly into a vehicle’s gas tank and used as fuel.

Stay here to take a sample of a pale white fungus growing on a rotting log laying on the forest floor. Locals use it to cure earaches.

Lose one turn to gather bark from a cinchona tree. It contains quinine, which the natives use to treat malaria.

You hear the beautiful sounds of flute music being played in the distance. Local people play music with instruments they make. Stay here to enjoy it.

You are startled by spider monkeys in the trees above you who are throwing small branches down at you. They do this to chase off intruders. Move ahead one space to get away.
You are lucky enough to spot a bright blue hyacinth macaw parrot. There are only 2500 left in all of Brazil due to poachers who sell them to pet dealers and the destruction of their habitat. Stop here to view.

WOW!!! A very rare golden lion tamarin is in the canopy above you. There are only 100 of these monkeys left in Brazil due to habitat destruction. Stop here to get a picture.

Stop here to take a drink from a hanging liana vine that you cut. These vines hold much water inside them. Local people know when they see this plant that fresh water is nearby.

Stop here one turn to visit with a local person. He has been out collecting honey by scooping it out of a bee hive in a hollow tree.

You spot a plant that the natives use to stop bleeding. Stop here to collect a specimen. One-fourth of all medicines available today come from plants.

You meet a local person who is collecting plants. One-fourth of all medicines come from plants. Stay here to see if he has any
samples that are new to you.

Stay here to visit with local people who have been out collecting Brazil and cashew nuts. They can make money without harming the forest by selling them to companies who will export them to other countries.

UNBELIEVABLE!!! You spot a rare blue morpho butterfly. In one square mile in the Amazon, there can be 1500 butterfly species. Stay here to get a picture.

What luck you are having! You meet a botanist who has been out collecting plant samples. Lose two turns to compare your specimens with hers.

Stay here to cut a small sample of a chondrodendron vine. It can be used as a muscle relaxant for surgery and also as a poison for the tips of arrow.

You must stay here one turn until an incredible downpour of rain stops. Take cover under the shelter of a huge kapok tree.
Looking up you see giant ferns towering above your head. Stay here to get a picture of this fantastic sight.

You meet two entomologists. These scientists study insects. The Amazon contains 8,000 species of insects!!

Animal Encounter Cards

You step on a bushmaster snake by accident and it bites you. These venomous snakes are one of the most feared in South America. Roll one die to see how many turns you must remain here to recover.

A harpy eagle dives from above the canopy after a monkey. Harpy eagles nest in the tallest trees, weigh up to 20 pounds, and may be three feet long from head to tail. Stop here to admire this awesome bird.

Stay here to get a picture of a hooded warbler. Many bird species migrate each year to tropical rain forests. Loss of rain forests may have already affected many species of birds.
You spot the slowest mammal in the world, a three-toed sloth. Sloths spend much of their lives upside down and have a covering of algae to camouflage them. Stop here to watch this very interesting character.

A centipede bites you. This relative of insects has 170 pairs of legs and hunts worms and insects. Lose 2 turns to recover.

A group of about 40 squirrel monkeys and capuchin monkeys are playing in the trees above you. These two species often travel together. Stay here your next turn to enjoy their games.

Stay here two turns to get pictures of a family of pygmy marmosets. These near-monkeys are only six inches long! They live in the same three or four trees all their life and eat sap and insects.

Roll one die to distance yourself from a Golden Arrow-Poison frog. One drop of this frog’s poison can kill a human. This specie of frog grows to only one and a half inches in length.

On the side of a nearby cliff you spot a big group of red, green, yellow, and blue macaws. These parrots are getting needed minerals
here. Stop here to get some colorful photos.

Lose one turn to watch a toucan bird eating fruit with its eight-inch long orange beak. Birds, bats, and fish help trees by eating fruit and then distributing seeds to a different location.

You spot a huge emerald tree boa high up in the trees. All boas kill their prey by squeezing it so they can not breathe. Stop here to observe.

Move ahead two spaces to get away from a large group of army ants. These ants eat insects and spiders but will even eat a large animal if it can not escape in time.

A distant roar of a howler monkey stops you in your tracks. These monkeys move through the trees quite slowly. Their roars can be heard two miles away and warn others that the area belongs to them.

Stop here to get a picture of an ocelot. Ocelots are hunted for their fur. They're excellent swimmers and can climb down trees head-first.
Lose one turn to watch a large group of leaf-cutters ants. They carry small pieces of leaves to their nest and use the fungus that grows on the leaves as food.

WOWyyyy! You see a giant anteater near you. It must be seven feet long! These animals use their razor-sharp claws to rip open logs to get at ants and termites to eat. Stay here two turns to take notes.

You spot an iguana high above your head. These lizards can grow up to six feet long! Stay here to get a picture.

Something glows in the sunlight near you: a colorful hummingbird with a red throat. There are over 120 species of these birds in the Amazon! Move ahead one space to get a chance at a better picture.

You see a jaguar high above you in a tree. These huge cats are endangered, due to loss of habitat and being hunted. Move ahead one space to distance yourself from this incredible animal.

You hear a noise behind a tree and see a giant armadillo.
Protective armor covers its body. It licks up insects with a long tongue. Stay here to get a picture.

A collared peccary comes towards you. These mammals look like huge pigs. Climb a tree and lose one turn to get away from its huge teeth that could cause you a lot of damage.

Stay here to get a picture of an agouti eating fruit on the forest floor. Agoutis are rodents the size of rabbits.

Move ahead one space to follow an incredible-looking clearwing butterfly. Its wings are almost transparent, which means you can almost see through them. Maybe you'll get lucky and get a picture!

QUIET!!! Stay here to watch a tapir, a small relative of the rhinoceros. Tapirs have very long snouts to help them find food. Also, they are complete vegetarians.

OUCH!!!!!! You have just been stung by a very large wasp. Lose two turns to recover.
You stop for a rest, but the log you are sitting on caves in! It seems termites have already claimed this log. They are important in the decay process.

You hear the loud, raucous cries of a group of parrots. They use their large bills to crack hard nuts and seeds. There are 100 types of parrots. Stay here to get a picture.

You spot two emperor tamarins with their white moustaches looking at you. They are “near monkeys,” which means they are related to, but not actually monkeys. Rest here to watch them.

Stay here to get a picture of an albino silky marmoset. These relatives of monkeys are almost all white.

You see a boa that is hanging from a tree like a liana vine! Boas have 300 pairs of ribs. Move ahead one space to get a clearer shot for a picture.

Stop here to watch a coati (an animal that looks like a large raccoon) eat a small green snake on the forest floor near you.
Stay here to try and get a picture of bees on a purple passion flower. Insects and birds are vital to flower pollination.

Stay here to get pictures of and notes on a hummingbird getting nectar from a hibiscus. Its bill is three inches long. It can fly 71 mph, and it can even fly backwards.

Stop here to get a photo of a beautiful bird that isn’t familiar to you. One-half of the 900 species of birds found here are found nowhere else on earth.

You spot a Lutz’s Phyllomedusa. These green frogs have yellow eyes. Their green color helps them avoid predators because it camouflages them. Stop here to get a picture.

Stop here to get a picture of a gold frog. These frog’s head and body is less than one inch long!

You look up and see a red-faced uacari monkey. These monkeys are great leapers, but do not have long tails to help them. Stay here to get a picture.
Stop here to admire a huge flock of parakeets. Their colors help them because they blend in with the greens of the Amazon.

Stop here to get a picture of a tree porcupine. Some porcupines in the Amazon can even hang from trees by their tails!

Don’t look now, but you have just seen a beetle the size of your fist! Stop here to get over your surprise.

Move ahead one space because you are lucky enough to catch a glimpse of a fruit-eating bat. This is unusual because bats are rarely seen in the daytime.

Stop here to get a good look at a large colony of weaver ants. They cut small pieces of leaves that they use to build their homes.

Move ahead two spaces to get a better look at lion marmoset. These near-monkeys earned their name because they have manes of fur surrounding their faces.

Are you imagining things, or did a leaf near you just move? After a closer look, you see that it is really a katydid, an insect that
looks like a leaf to fool its predators. Stop here for a closer look.

Careful! Go back one space to avoid contact with a whip scorpion. These animals do not have stingers. Instead, they sense their prey with antennae and use pincers to kill them.

Stay here and be very quiet to watch a mother deer with her doe. These animals look for their food near the forest floor.

WOW!!!! You have just spotted a rare blue morpho butterfly! Stay here to try and get a picture. When the sunlight hits these splendid insects, they glow like blue flashes of light.

Stay here to watch a large group of spider monkeys in the trees above you. They are acrobats in the trees and have a long tail to help with climbing.

Be very CAREFUL!!!! Calmly move ahead one space to get away from a giant toad near you. These animals are poisonous and may even shoot poison at an attacker, which may cause blindness.

Stay here to take notes on a tarantula. These huge spiders may
grow to be as large as your hand. Their only enemy is the hunting wasp, which stings them to death.

Move ahead two spaces to get away from a puma. A member of the cat family, they can leap 20 feet! They can grow to almost seven feet long and may weigh 225 pounds. They are skilled hunters.

River Rolls Chart

Roll two dice and multiply them together. Find this total on the chart below, read the instructions aloud, and follow the directions listed.

<table>
<thead>
<tr>
<th>Roll</th>
<th>Directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stop here to look at a capybara (cop-oo-BAR-a) eating grass. Capybaras are related to North American beavers and are the largest rodents in the world. They look like very large guinea pigs.</td>
</tr>
<tr>
<td>2</td>
<td>Amazingly enough, you spot a rare pink Amazon River dolphin! Locals believe to hurt or kill a freshwater dolphin brings bad luck or</td>
</tr>
</tbody>
</table>
ill-health. Lose one turn here to get some pictures.

3 You see a large group of red pirhana (puu-RAH-na) attacking a tapir (TAPE-er) in the river. A school of these fish can eat a large animal in minutes. Amazingly enough, there are twenty species of Amazon pirhana. Stop here to view this incredible display.

4 You almost step on a caiman (KAY-men) you thought was a log. These animals are related to crocodiles. Lose one turn to get over your fright.

5 The noise you make startles a large flock of egrets and they fly away. Move ahead one space, but be sure to go as quietly as possible.

6 Stop here to watch a sting ray in the river. These animals originally lived in salt water, but some adapted to fresh water after being trapped in the river.

8 Lose one turn to admire thousands of white butterflies that have landed on the river to get salt.
9  Move ahead two spaces to get a better view of an anaconda. These snakes can be 30 feet long and are the heaviest snakes (up to 300 pounds) in the world.

10  You have just noticed a leech that has been sucking the blood out of your leg. Stop here to remove it.

12  A pirarucu (peer-are-oo-KOO) fish makes a loud splash. This is one of the largest fresh water fish species in the world and may grow to nine feet long! You are so amazed at this that you move ahead two spaces to follow it. There are at least 2000 species of fish in the Amazon River!

15  Stay here for your next turn to watch a family of river otter playing. You feel very lucky, for these are rare giant river otters which can grow up to six feet long.

16  The riverbank is especially thick and tangled with vegetation because there is more light here. You are in place that is very hard to get through. Lose one turn to pick your way through.

18  Freeze here to observe a coal-black jaguar. Males can weigh
almost 300 pounds! They eat crocodiles, frogs, and fish and may even fight with a boa constrictor snake.

20 Stop here to watch a bright red scarlet ibis bird.

24 You spot an electric eel that has just shocked a fish. These animals use 500 volts of electricity or more to stun their prey. Stop here to watch this incredible creature.

25 Lose one turn to get a picture of a frog sunning itself on a giant lily pad that must be six feet across!

30 Move ahead one space to get a closer look at a large group of Jabiru storks in the water. They are the largest birds in North and South America and may be ten feet from wing tip to wing tip.

36 You see a freshwater turtle in the river very close to you. At three feet long, they are the largest in the world. Stay here two turns to take notes on this magnificent creature.
REFERENCES

Allen, L.E., Jackson, G., Ross, J., & White, S. (1978). What counts is how the game is scored: One way to increase achievement in learning mathematics. Simulation and Games, 9, 371-389.


Butler, R.J., Markulis, P.M., & Strang, D.R. (1988). Where are we? An analysis of the methods and focus of the research on simulation gaming. Simulation and Games, 19, 3-26.


