Image from an active reclamation site at Coal Valley Mine, Alberta

# Land Reclamation

LAND RECLAMATION
INTERNATIONAL GRADUATE SCHOOL

## Become An Earth Doctor Game

Image from a Land Reclamation International Graduate School visit at the Genesee Generating Station, Alberta

Image from a Land Reclamation International Graduate School field trip to British Columbia

# Table Of Contents

# Game Overview

Become An Earth Doctor was created in 2019 by land reclamation scientists and members of the Land Reclamation International Graduate School (LRIGS) at the University of Alberta, to explore the concepts and stages of land reclamation in a fun, engaging, and accessible game. Land reclamation is the process of converting disturbed land back to a productive end land use. The end land use is what the site will be after reclamation, and can include forests, grasslands, agricultural lands, wetlands, lakes, and even a recreational area for nearby residents. Land reclamation is needed following anthropogenic (human-caused) disturbances such as mining, forestry, and roadways and following natural disturbances such as forest fires, flooding, and earthquakes.

The game was designed as a teaching tool to engage everybody with land reclamation, and has been used in virtual and in person classrooms, for kindergarten to university students and community members, across Alberta and Canada. Players will face the challenges of reclaiming disturbed land, work towards a desired end land use, and gain knowledge to remove contaminants, build soil, restore vegetation, and try to heal the Earth. A resource presentation is available, to assist with leading users through the game.

# Game Licensing

The Become An Earth Doctor game is licensed under a Creative Commons Attribution-Non Commercial-Share Alike 4.0 International License (creativecommon.org). Users are free to copy and redistribute the game material in any medium or format and to remix, transform, and build upon the game material, as long as the below license terms are adhered to.

**Attribution:** Users must give appropriate credit to the Land Reclamation International Graduate School (LRIGS), provide a link to the license, and indicate if changes were made. This may be done in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

**Non-Commercial:** Users may not use the game material for any type of commercial purposes.

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**No Additional Restrictions:** Users may not apply legal terms or technical measures that legally restrict others from doing anything the license permits.

# Become An Earth Doctor Playing Guidelines

## INTRODUCTION

Welcome To Become An Earth Doctor!

In this game, you will become an Earth Doctor and try to reclaim a site. You will be working towards a desired end land use (what the site will be after reclamation) and gain the knowledge to eliminate contaminants, heal soil, and restore vegetation.

To be a successful Earth Doctor, your reclamation project must be on budget and on time and keep your stakeholders happy.

## KEY TERMS

**Land Reclamation:** converting disturbed land to previous conditions or other productive uses.

**Contaminant Remediation:** removal or reduction of contaminants or unwanted substances.

**Soil Reclamation:** formation of a healthy soil system. Can include returning stockpiled soil to a disturbed site, amending soil, building new soil, etc.

**Revegetation:** providing disturbed land with vegetation cover.

**Stakeholder:** a person or group with an interest in the process and outcome of the reclamation project.

## HOW TO START

You will need a six-sided dice (or number generator set to 1 to 6), 6 items to represent your stakeholders, a score sheet, a pen or pencil, and a set of cards. Take your 6 items and set 3 in front of you (representing stakeholders that support you) and 3 off to the side (representing stakeholders that you need to convince). As the game goes on, you can gain and lose stakeholders.

Your score card will help you keep track of your initial cost and time points, and the amount of points you have used for each reclamation step.

Once you have each of these items gathered, you are ready to become an Earth Doctor!

## HOW TO PLAY

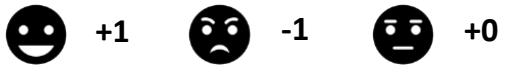
Earth Doctors begin by selecting an end land use. This will determine the budget and timeline required for the reclamation project.

After determining the end land use, you will select your **contaminant remediation**, **soil reclamation**, and **revegetation** methods.

Start by selecting your contaminant remediation method and roll your dice. Consider the cost and timeline and effectiveness of each method. Effectiveness refers to how likely the method is to succeed, which is represented by the dice numbers on the cards. To be successful for each step, Earth Doctors **must roll the number specified** on the contaminant remediation card. If successful, you may move onto the next step. If unsuccessful you can roll again for the same card or select a different method.

Each time you roll (successful and unsuccessful) you will use time and cost points. **Keep track of each roll in the respective step of your score sheet**. Once you have successfully rolled an effective number, you may move on to soil reclamation, and then revegetation, following the same process

Each method has a stakeholder opinion. Each roll of the dice will result in your gaining, losing, or maintaining your stakeholders, indicated by the face below. This means you can gain or lose more than 1 stakeholder in each round of the game.



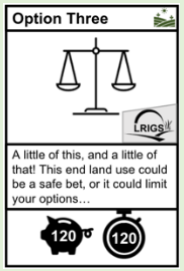

During reclamation, there can be many factors that will positively or negatively affect a project. Out of 24 possible situations you could experience, **draw or randomly select 3 risk cards**, and add or subtract the points using your score sheet.

### RECLAMATION SUCCESS

To determine if you were a successful Earth Doctor, assess your final cost and time points, and the number of stakeholders that supported you throughout the project. If you were on budget, on time, and had stakeholders supporting your project, **you were successful!**

## GAME EXAMPLE

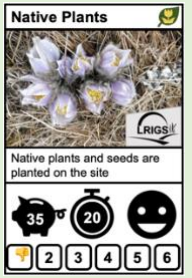
**Step 1: Select your end land use**




**Step 2: Contaminant remediation**


**Step 3: Soil reclamation**


**Step 4: Revegetation**




**Step 5: Identify project risks**


**Determine your success**

# Become An Earth Doctor Hosting Guidelines

## INTRODUCTION

Welcome to Become An Earth Doctor!

In this game, you will lead your audience to become Earth Doctors. The goal of the game is to reclaim a site by working towards a desired end land use, what the site will be after reclamation, and gain the knowledge to eliminate contaminants, heal soil, and restore vegetation.

To win, to be a successful Earth Doctor, the reclamation project must be on budget and on time and keep the stakeholders happy.

## KEY TERMS

As you are hosting, you may need to explain definitions and processes for your audience. Here are some of the key definitions; however, you may need to do additional research.

**Land Reclamation:** converting disturbed land to previous conditions or other productive uses.

**Contaminant Remediation:** removal or reduction of contaminants or unwanted substances.

**Soil Reclamation:** formation of a healthy soil system. Can include returning stockpiled soil to a disturbed site, amending soil, building new soil, etc.

**Revegetation:** providing disturbed land with vegetation cover.

## HOW TO START

**Playing format:** play as individuals or divide the audience split into teams.

**Materials needed:** a six-sided dice (or number generator set to 1 to 6), 6 items to represent your stakeholders, a score sheet, and a pen or pencil for each team or individual. If playing in person, they will need a copy of the playing cards.

**Set up:** have the players place 3 of the 6 items in front of you (representing stakeholders that support the project) and 3 off to the side (representing stakeholders that need to be convinced). As the game goes on, players can gain and lose stakeholders. They need to end the game with at least one.

**Score card:** use to track the initial cost and time points, and amount of points used for each reclamation step.

Once you have each of these items gathered, you are ready to become an Earth Doctor!

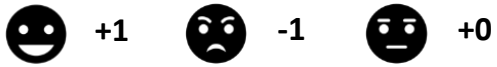
## HOW TO PLAY

Earth Doctors begin by selecting an end land use. An end land use could be a park or a forest or a community garden. Have each individual or team write their chosen end land use at the top of their score card. Then they need to select the strategy for the game; each of the 3 options (end land uses) have different budgets and timelines. Once they have selected, have the players write the budget and timeline on the top line of the score card. After determining the end land use, players will select their **contaminant remediation**, **soil reclamation**, and **revegetation** methods.

As the host, you can 1) describe each of the methods to your players or 2) give them time to read through the options on their own. Once they understand the four options, have them select one, keeping in mind the cost, time, stakeholder opinion, and effectiveness, and roll the dice. Effectiveness refers to how likely the method is to succeed, which is represented by the dice numbers on the cards. To be successful for each step, Earth Doctors **must roll one of the numbers specified** on the chosen card. If successful, they may move onto the next step. If unsuccessful they can roll again for the same card or select a different method.

Each time they roll (successful and unsuccessful), they must subtract time and cost points. For example, if they select biopiling and roll a 1 on the first roll (fail) and a 5 on the second (success), they have to pay twice (a total of 30 cost and 30 time points). **Keep track of each roll in the respective step of the score sheet**. Once they roll an effective number, they move on to soil reclamation, and then revegetation, following the same process.

Each card has a stakeholder opinion. Each roll of the dice will result in them gaining, losing, or maintaining stakeholders, indicated by the face below. This means they can gain or lose more than 1 stakeholder in each round of the game.



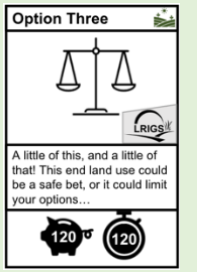

During reclamation, there can be many factors that will positively or negatively affect a project. Have your players **draw or randomly select 3 risk cards** from the described 24 possible situations and add or subtract the points using the score sheet.

### RECLAMATION SUCCESS

To win the game, the players must assess their final cost and time points, and the number of stakeholders remaining. If they were on budget, on time, and had stakeholders supporting their project, **they were successful!** Encourage them to play again, making different choices. Discuss what the challenges were.

## GAME EXAMPLE

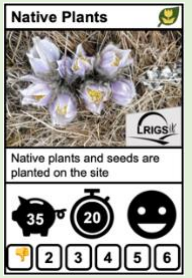
**Step 1: Select your end land use**




**Step 2: Contaminant remediation**


**Step 3: Soil reclamation**


**Step 4: Revegetation**




**Step 5: Identify project risks**


**Determine your success**

# Printable Playing Cards

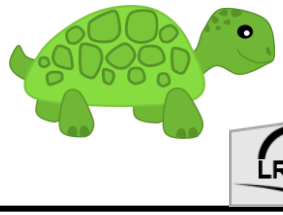
Playing cards for the Become An Earth Doctor game include the main game cards and risk cards. Main game cards cover the stages of land reclamation: end land use, contaminant remediation, soil reclamation and revegetation. Risk cards introduce factors or events that can negatively or positively affect your reclamation project.

Select either the basic or detailed score sheet, basic (page 16) or detailed (pages 17 to 18), to be used. Print the main game cards (pages 7 to 10) and your selected score sheet double sided, staple sheets together as a package. Print risk cards (pages 10 to 15) single sided and cut out individual cards. Print game certificates (page 20) and fill in participant names and date of game play.

Image from a Land Reclamation International Graduate School field trip to Nova Scotia

# Game Cards: End Land Use

**Option One**



Slow and steady wins the reclamation race! This end land use is not expensive, but it takes a long time.

80 | 160

**Option Two**

Money, money, money, money…money! This end land use is expensive, but it doesn't take much time.

160 | 80

**Option Three**

A little of this, and a little of that! This end land use could be a safe decision, or it could limit your options.

120 | 120

# Game Cards: Contaminant Remediation

**Natural Attenuation**


Contaminants removed by microorganisms in the soil

5 | 25 | 5 | 6

**Biopiling**


Soil dug up, piled, amended, and assessed for improvement

15 | 15 | 4 | 5 | 6

**Thermal Desorption**


Soil heated to >150 °C to reduce contaminants, aka a soil oven

25 | 10 | 2 | 3 | 4 | 5 | 6

**Dig And Dump**


Soil dug up, discarded in a landfill, new soil is added

30 | 5 | 2 | 3 | 4 | 5 | 6

# Game Cards: Soil Reclamation

**Manure**


Animal wastes increase carbon nutrients, water holding capacity

20 | 15 | 4 5 6

**Fertilizer**


Inorganic nutrients are added to increase fertility

35 | 5 | 4 5 6

**Salvaged Materials**


Salvaged soil, peat, LFH, etc are taken from another site or onsite

25 | 20 | 2 3 4 5 6

**Nothing**


Soil is not reclaimed and left for nature to recover

0 | 40 | 6

# Game Cards: Revegetation

**Native Plants**


Native plants and seeds are planted on the site

35 20 2 3 4 5 6

**Non-Native Plants**


Non-native plants and seeds are planted on the site

15 10 4 5 6

**Mixed Planting**


Native and non-native plants and seeds are planted

25 15 3 4 5 6

**Nothing**


Nothing is planted

0 35 6

# Risk Cards

**1 When It Rains**

A heavy rainstorm hits your site and washes away all your plants

-20 -20

**2 Snow Big Deal**

Skiers cause an avalanche that blocks the road to your site

-5 -5

**3 Research Rules**

Scientists develop an inexpensive all-in-one soil amendment

+5 0

**4 Bluetooth Shovel**

A company tests their state-of-the-art equipment on your site

+5 0

# Risk Cards

**5 Invaders**

An invasive species establishes that requires herbicide and weeding

-10 -5

**6 Turn It Off Or On**

Call a mechanic, your equipment breaks down

-5 -5

**7 For The Gram**

A community group gets involved and helps with planting

+5 +5

**8 Don't Badger Me**


An endangered female badger makes itself at home and has babies

+10 +10

# Risk Cards

**9 First Job**

During monitoring, you spill diesel filling your truck, better clean it up

-15 | -10

**10 Hooligans**

Teenagers trespass on your site, quick, install some fences

-5 | 0

**11 Elon Musk-eg**

A nature loving billionaire donates to your reclamation project

+10 | 0

**12 Improved Access**

The road to your site is paved, making it easier to reach your site

+5 | +5

# Risk Cards

**13 Screamer**


A tornado hits your site and removes all your vegetation

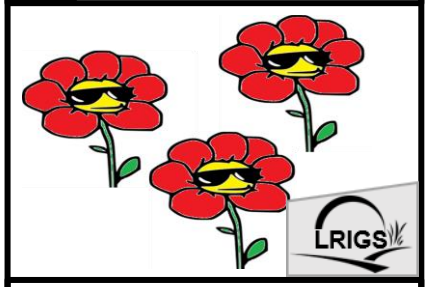
-10 -15

**14 Summer Scorch**


A wildfire reaches your site, 50 % of vegetation re-establishes

-10 -10

**15 Nature Giveth**




Optimal growing conditions speed up your revegetation

+10 +10

**16 Get A Bryologist**


Monitoring finds a target moss species on your site

+10 0

# Risk Cards

**17 Need Moisturizer**

Climate change induced super drought kills some of your vegetation

-15 -5

**18 Mudslide**

Rapid spring thaw results in a mudslide washing away your topsoil

-30 -20

**19 Black Gold**

Soil quality was better than expected, requiring fewer amendments

+5 0

**20 Stakeholder Win**

A community partnership results in volunteers to help with monitoring

+10 0

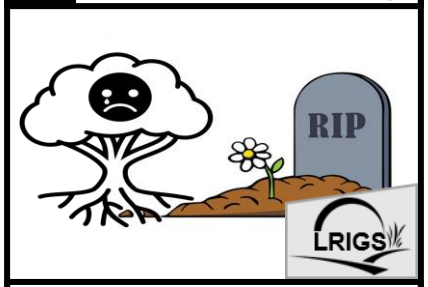
# Risk Cards

**21 Salad Bar**


Wildlife snacks on some of your newly planted vegetation

-5 -5

**22 Summer Job**




You hired inexperienced tree planters, most trees don't survive year 1

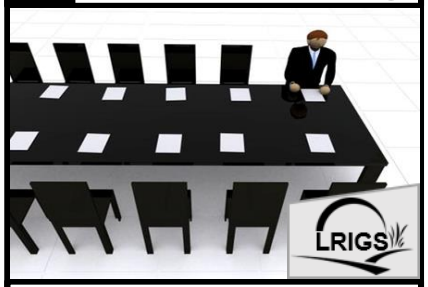
-10 -10

**23 Bearly Monitored**


A bear takes up residence on site and stalls monitoring plans

0 -10

**24 Remedi-Gate**




Public consultation with nearby First Nation was insufficient, do better

0 -10

# BECOME AN EARTH DOCTOR BASIC SCORE SHEET

**IMAGINE AN END LAND USE.** When my land reclamation project is finished, I will have a _____.

| STEP | COST POINTS | TIME POINTS |
|---|---|---|
| End Land Use Starting Points | | |
| Contaminant Remediation | | |
| Soil Reclamation | | |
| Revegetation | | |
| Risk Card 1 | | |
| Risk Card 2 | | |
| Risk Card 3 | | |
| Remaining Points | | |

**WAS YOUR LAND RECLAMATION PROJECT SUCCESSFUL?**

# BECOME AN EARTH DOCTOR DETAILED SCORE SHEET

**IMAGINE AN END LAND USE.** When my land reclamation project is finished, I will have a _____.

| ROLL UNTIL YOU SUCCEED AT REMEDIATION | | | |
|---|---|---|---|
| **Contaminant Remediation Method** | | **Starting Total** | **Starting Total $** |
| | | | |
| **Number Rolled** | **F or S** | **Total - Used =** | **Total $ - $ Used =** |
| | | | |
| | | | |
| | | | |
| | | | |
| **POINTS REMAINING** | | | |

| ROLL UNTIL YOU SUCCEED AT SOIL RECLAMATION | | | |
|---|---|---|---|
| **Soil Reclamation Method** | | **Starting Total** | **Starting Total $** |
| | | | |
| **Number Rolled** | **F or S** | **Total - Used =** | **Total $ - $ Used =** |
| | | | |
| | | | |
| | | | |
| | | | |
| **POINTS REMAINING** | | | |

| ROLL UNTIL YOU SUCCEED AT REVEGETATION | | | |
|---|---|---|---|
| **Revegetation Method** | | **Starting Total 🕒** | **Starting Total $** |
| | | | |
| **Number Rolled** | **F or S** | **Total 🕒 - 🕒 Used =** | **Total $ - $ Used =** |
| | | | |
| | | | |
| | | | |
| | | | |
| **POINTS REMAINING** | | | |

**DO YOU HAVE STAKEHOLDERS SUPPORTING YOUR LAND RECLAMATION PROJECT?**

| **TIME TO RISK IT ALL!** | **Starting Total 🕒** | **Starting Total $** |
|---|---|---|
| | | |
| **Risk Card Number** | **Total 🕒 + or - 🕒 =** | **Total $ + or - $ =** |
| | | |
| | | |
| | | |
| **FINAL POINTS REMAINING** | | |

| LAND RECLAMATION PROJECT OUTCOME | WHAT DOES IT MEAN | ✓ |
|---|---|---|
| Both **$** and 🕒 | Success | |
| Some **$** but no 🕒 | Partial success | |
| Some 🕒 but no **$** | Partial success | |
| No **$**, no 🕒 | If at first you don't succeed… reclaim again! | |


# LET IT BE KNOWN THAT

PARTICIPATED IN THE LAND RECLAMATION INTERNATIONAL GRADUATE SCHOOL'S BECOME AN EARTH DOCTOR PROGRAM AND IS THEREFORE DESIGNATED AS AN

# HONOURARY EARTH DOCTOR


ON THE____ DAY, OF THE ____MONTH,
IN THE YEAR _____.