

Legion 44 High School Discussion Guide

Tuvalu



legion44.world



Synopsis

What happens when there's a breakthrough? When, spontaneously, young people innovate and turn back what appears to be unstoppable catastrophe? Legion 44 chronicles these visionaries, many from the Global South, who have invented groundbreaking solutions to reverse climate disruption. Our film shows we can indeed make everything right again. We start with the cautionary tale of Tuvalu that amidst global inaction and rising seas, is putting themselves into the metaverse to preserve their culture. To which emerges our Legion, who answer the call and invent carbon removal. Building from the basic science of rocks, water and carbon, the film takes off and we see how human ingenuity can keep Tuvalu and other low-lying lands from going under. Legion 44 at times incorporates montages that shows a world distracted and so depressed that they have given up. But our heroes persist on. This Legion is highly collaborative and from all walks of life and backgrounds. We journey to the Hajar mountains in Oman, to the vulnerable islands of Tuvalu, to the Rift Valley in Kenya, to the Southern Sahara in Morocco, to the Sargassum-rich seas of St. Vincent. Legion 44 is more than a film, it is a love letter to humanity, and the 3rd film on climate by Leila Conners. With Walton Goggins as narrator, his heartfelt compassion supports this tone. Conners works with Bosnian cinematographer Harun Mehmedinovic and his choice of anamorphic lenses to show collaboration in context. Legion 44 included Sun Creature from Denmark/France to build graphics that joyfully show the inner workings of the science. And most poignant, Marc Streitenfeld's strong score tinged with hope and yearning is a main pillar in our journey given that, will the world accept this pathway and scale in time? Conners has followed humanity's struggle with climate for over 20 years--first with *The 11th Hour*, then with *Ice on Fire*. Now she brings Legion 44 at a pivotal moment: will we inspire real action to fix climate once and for all?



Learning Objectives

- Students will be introduced to various carbon dioxide removal approaches and analyze the role they play in climate change mitigation
- Students will respond to themes in the film, illustrating a deeper understanding for how carbon removal could play a part in addressing climate change
- Students will make inferences and draw conclusions about the emergence and scaling of the carbon removal industry
- Students will make inferences and draw conclusions about the filmmaker and their decisions to use this film to communicate and educate about carbon removal
- After viewing the film, students can generate similar research topics on climate change solutions, formulate open-ended questions, and generate a plan to gather needed information from a variety of resources

Teacher Notes

This discussion guide has been divided up into sections to allow time for students to respond to the questions and discuss the film. Before each new section, go over the questions that will be addressed so that students will be able to focus on the information needed for discussion points. Depending on how you decide to present the lesson, you may break the lesson up into several class periods.



Part 1 | Introduction to the Effects of Climate Disruption & Carbon Removal as a Solution

(00:00 - 18:24)

In this section students are introduced to the impacts of climate change, and how certain groups are responding, namely, the island of Tuvalu and the Suswa Maasai in Kenya. They will also be introduced to the concept of carbon dioxide removal, or removing carbon dioxide emissions directly from the atmosphere.

1. What alternative actions has the island of Tuvalu taken in the absence of global response following previous discussions, such as Conference of the Parties (COP), and how are they using these actions as a precautionary tale?
2. A member from the Suswa Maasai asks Corey the question, “Do you think we can achieve climate change mitigation without peace?” Why do you think this question may be top-of-mind for communities such as this one, and how does the lack of peace between Global North countries impact their ability to deliver on promises they have made Global South communities before?
3. How have permanent carbon pools been disrupted, and what has been the benefit of disrupting them? What has been the tradeoff of disrupting them?
4. Define carbon dioxide removal (CDR) in your own words.
5. How has CDR been used in other contexts before being thought of as a way to contribute to climate change mitigation?
6. Before humans, how has the Earth regulated the the temperature and CO2 concentration in the atmosphere before?



Part 2 | Enhanced Rock Weathering and Direct Air Capture: A Start to the CDR Portfolio

(18:24 - 33:27)

In this section students are introduced to three different companies, all working towards different carbon removal solutions. Silicate and Lithos are using enhanced rock weathering and Climeworks uses direct air capture.

1. Maurice indicates the benefit of having the waste concrete feedstock close to the fields where it is being applied. Why do you think this is important for business operations and for the climate?
2. In addition to the benefit of fixing the carbon in the soil and the increased carbonic acid, what is the benefit of spreading waste concrete over croplands?
3. Why is "liming" a required practice in the Eastern farms in the US?
4. Both Silicate and Lithos use waste materials to spread on their croplands. What are some benefits you see from using waste materials for both a business opportunity and for the climate?
5. Frank Clowdis mentions that farmers must "do their homework" to optimize their operations. Do you think that most farmers are familiar with applying waste concrete and/or basalt on their croplands and the benefit of crop health and carbon removal? If so, where do you think they are able to encouraged to access information? If not, how do you think this information could be made more accessible?



Part 2 | Enhanced Rock Weathering and Direct Air Capture: A Start to the CDR Portfolio

(18:24 - 33:27)

6. We see Climeworks' illustration of how direct air capture works. What did they do with the CO₂ that they captured from their first direct air capture plant? How is this different from what they are doing in Iceland now?
7. Jan mentions that direct air capture could theoretically scale up to whatever capacity it needs to be at to meet climate goals. Based on what you saw from the explanation of direct air capture, what might be some real-world limitations to its ability to scale up?
8. What is the difference between short-term and long-term carbon pools and how are these related to the different approaches to carbon dioxide removal you've already seen in the film, or those that you know about from background knowledge?



Part 3 | Carbon Removal in Kenya & Natural Resources for Carbon Storage in Oman

(33:27 - 53:09)

In this section the potential for carbon removal to be rapidly scaled in the Kenya is discussed. In addition, a geologic CO₂ storage company is featured, illustrating the technology that allows for CO₂ to stay permanently stored underground.

1. Why does Ugbaad say that the climate crisis is not actually “impending,” and who is the climate crisis most likely to impact the most?
2. Provided that there are other approaches to climate change mitigation, including renewable energy and reducing consumption, what are the three ways that carbon dioxide removal can be leveraged to address climate change mitigation?
3. What are some of the characteristics of Kenya that make it an optimal place to deploy carbon dioxide removal technology and scale the carbon dioxide removal industry?
4. How can scaling the carbon dioxide removal industry in Kenya change the way that Kenya, and Africa as a whole, is discussed and considered in the conversations about climate change?
5. What does it mean to leap-frog over carbon-intensive development and how could this framework change the idea of what it means for a country to industrialize?
6. Describe the mineralization of carbon dioxide in your own words.
7. What does Mike, at Octavia Carbon, say is the gift that the Rift Valley provides to the world and how does it help Octavia Carbon to be positioned as direct air capture leaders in Kenya?



Part 3 | Carbon Removal in Kenya & Natural Resources for Carbon Storage in Oman (33:27 - 53:09)

8. Talal, from 44.01, mentions that the CO₂ they are using in their process comes from direct air capture using solar energy. Why is it important for CDR pathways to source their CO₂ from direct air capture operations, as opposed to big emitters, like oil and gas, or cement production?
9. Some people are skeptical about underground, geologic CO₂ storage. How do you feel about doing small volumes of CO₂ injection into the perioditite rock before scaling to larger volumes?



Part 4 | Scaling and Speed

(53:09 - 1:07:07)

In this section, the scale that the industry needs to grow to and how to get there is explored. The scaling of the industry is discussed from the view of policymakers, technology developers, and funding partners.

1. How much does the CDR industry need to scale, and how can this be described in year-on-year growth over a period of time? How does this compare to the growth-rate of solar energy?
2. How much CO₂ is removed per year today? How does this compare to how much CO₂ is emitted per year? How much of the removed CO₂ is durable, permanent carbon removal?
3. How many iterations of technology can be seen in Heirloom's small, internal plant, Durado?
4. Describe Heirloom's direct air capture process in your own words.
5. Why is the Bioenergie biochar plant referred to a 'reverse power plant'?
6. What makes biochar such a versatile product?
7. Carbon Removal Partners is a venture capital firm focused on carbon removal technologies, after seeing how much infrastructure goes into some of these approaches, what role do you think investors play in sparking the scale of the industry?



Part 4 | Scaling and Speed

(53:09 - 1:07:07)

8. What is the role of prize-based funding opportunities, like XPRIZE, and how does it compare to venture capital?
9. What role do you see CO₂ utilization, such as that going from CO₂ → valuable products, in addressing climate change? Compare and contrast this to the role of carbon removal with dedicated storage.
10. Benjamin, from Carbon Removal Partners, mentions that we need to think about the initiatives and support systems needed for the carbon removal economy in the next 12 months. One of the things this industry desperately needs is more people who want to devote their lives to developing these solutions. What initiatives or support systems do you think would help with this recruitment?



Part 5 | Carbon Removal using Oceans

(1:07:07 - 1:25:40)

In this section carbon removal using approaches that interface with the ocean are explored. These range from utilizing plant life in the ocean and using ocean geochemistry to drawdown CO₂ from the atmosphere.

1. Describe Seafields' process in your own words.
2. What are the non-carbon benefits of using sargassum in the Seafields' process?
3. How long do the sargassum bales take to sink? How far is it sinking and why was this basalt plain region of the ocean chosen for the sinking process?
4. Where might Seafields lose CO₂ in their process?
5. Describe Planetary's process in your own words.
6. How much would the concentration of CO₂ in the ocean increase if you were to use Planetary's approach to bring atmospheric levels back down to 280 ppm?
7. Describe Brilliant Planet's process in your own words.
8. What makes algae more efficient at growing than land-based plant matter?
9. How long has it been since the cold seawater has seen the surface and how much carbon removal can be achieved using Brilliant Planet's method if it was to be deployed on the 500,000 square km they say are the most suitable locations?

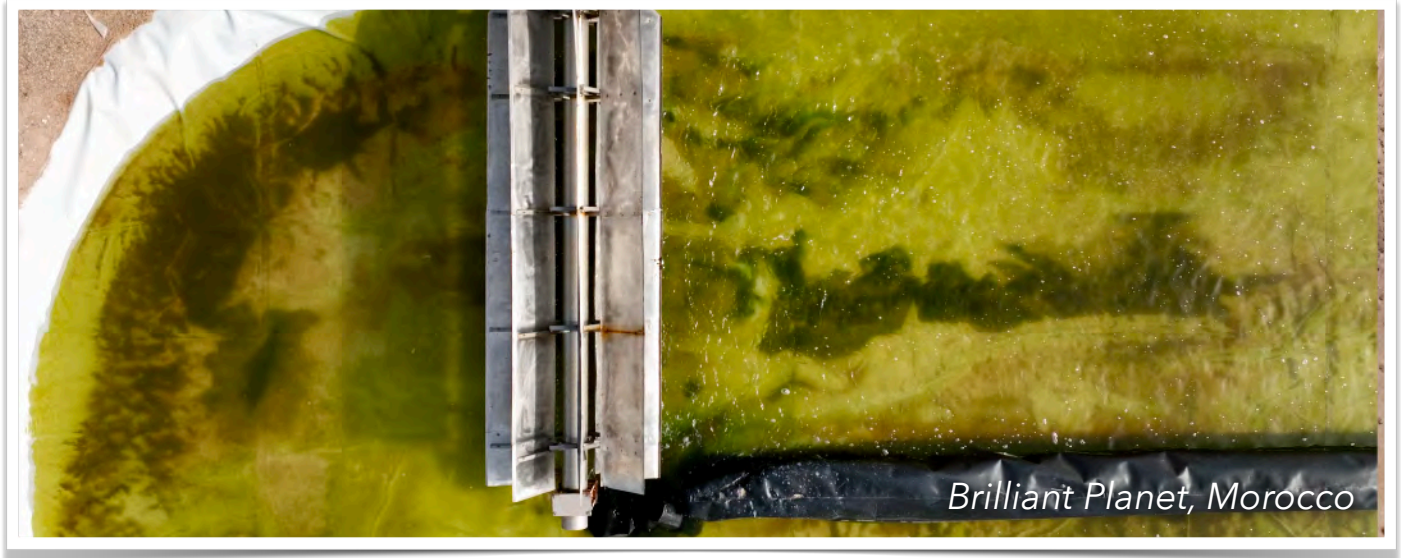


Part 6 | Monitoring, Reporting, and Verification & Carbon Markets

(1:25:40 - 1:37:37)

In this section, the way we account for carbon removal activities, especially since we can't see the molecules, is discussed. Furthermore, how this accounting can then be utilized in a market is explored.

1. What is one of the current open questions with regard to carbon credits derived from enhanced rock weathering approach to carbon removal?
2. Heirloom and Icarus emphasize that the monitoring, reporting, and verification for the direct air capture facility is being performed by a 3rd-party. Why do you think this is so important?
3. What do you think Carbonfuture will need as part of their digital platform to build the "trust infrastructure" in the carbon removal industry? What do you think is going to be the most difficult feature/aspect/data to achieve a true "trust infrastructure?"
4. Why does Anu refer to the current method as "fudging the math," and how do you think this will change when carbon removal is accurately credited?



Concluding Questions

1. What was the most interesting thing you learned while watching the Legion 44 film?
2. What challenge(s) mentioned from the film are most intriguing to you?
3. Many people talk about a portfolio of solutions to address climate change. Based on the various approaches to carbon removal showcased in the film, would you agree with this statement, why or why not?
4. What are the broader implications of carbon removal deployment and who is important to engage in this dialogue? Think about future workforce, governance, MRV, carbon markets, and technology development as you answer this question.
5. Do you think the film was an effective way to communicate and educate carbon removal technologies and the considerations as the industry scales? Why or why not?



Ways to Engage

1. Share this film! Give others a chance to learn about CDR and how it has the potential to impact how we address climate change.
2. Get Involved! Visit <https://www.legion44.world/> and Join the Legion 44 Movement! Here you'll have the opportunity to request the Legion 44 documentary be brought to a corporation/organization or school/university near you. Additionally, there are options for House Parties, as a way to continue spreading the message with your inner circle.
3. Build Something! Visit <https://www.legion44.world/diy-cdr> and browse projects that can help you to learn more about CDR through experiments and projects that you can do with local organizations, school organizations, or even in your own home!
4. Educate Yourself and Others! Keep learning about CDR and share your key takeaways with others. You'd probably be surprised by how few people know about CDR, but how many are interested in it, once you get them talking about the incredible opportunities for these approaches!

**For more
information:
info@legion44.world**



legion44.world

Seafields, St. Vincent & the Grenadines