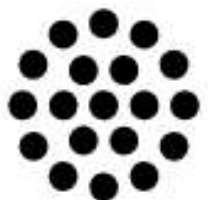




Climate Change Education Across the Curriculum Across the Globe

www.tropicsu.org



**International
Science Council**





The TROP-ICSU Project



TROPICSU workshop France



TROPICSU workshop Australia



TROPICSU workshop China

- While impact of Climate Change is felt across world, the nature of the impact varies from location to location.
- *The climate change problem, therefore, requires locally-rooted solutions, but based on global science.*
- This require the entire human population to be aware of cause and impact of climate change



The TROP-ICSU Project



TROPICSU workshop Uganda



TROPICSU workshop Bhutan

Our vision is Democratization of Knowledge through freely accessible digital resources, which helps all of humanity to invest their talent, skills and ambition in a focused way to address the problems of climate change.



The TROP-ICSU Project



- We have developed/developing educational resources (Teaching Tools and Lesson Plans) that bring climate studies into the mainstream education.
- Resources are designed to integrate climate science with core curriculum of high school and undergraduate college syllabi across the world
- *Idea is not to make climate change education a stand-alone topic rather bring it to the core of all curriculum of the formal education system.*



TROPICSU workshop India



TROPICSU workshop Egypt



**EDUCATIONAL RESOURCES
for TEACHERS
to INTEGRATE CLIMATE TOPICS
across THE CURRICULUM**

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The quality of life of future generations is largely dependent on the quality of education that we impart to today's students. Educational methods are more effective when students are challenged to identify the cause and effect of a problem that they can relate to their life.

Climate change is considered to be the most critical factor affecting sustainable and equitable development, increasing conflicts, and causing massive extinction of species. Addressing the climate change issue is an essential step toward achieving the Sustainable Development Goals (SDGs). As the impact of climate change is inseparable from our day-to-day life, now and in future, it is both a problem to be addressed and a problem that can be adopted for more effective teaching.



Vision

We aim to integrate relevant education and science communication modules in the education system to help future citizens across the globe in improving their understanding of the science of climate change and in developing necessary skills to mitigate its impact.



Project

TROP ICSU ("Trans-disciplinary Research Oriented Pedagogy for Improving Climate Studies and Understanding") is a global project funded by the International Council of Science. The project is led by International Union of Biological Sciences (IUBS) and co-led by International Union For Quaternary Research (INQUA).



Strategy

We collate and curate digital/ICT-based teaching resources that integrate climate studies across the curriculum of Science, Mathematics, Social Sciences and Humanities. These teaching resources are locally rooted in their context, but globally relevant for their science.



The TROP-ICSU Project



We have developed model teaching and learning modules as proof of concept of integrating climate change-related topics across the curriculum.

They are designed and packaged such that teachers across the world can use them to impart trans-disciplinary training that is essential for addressing the problems of climate change.

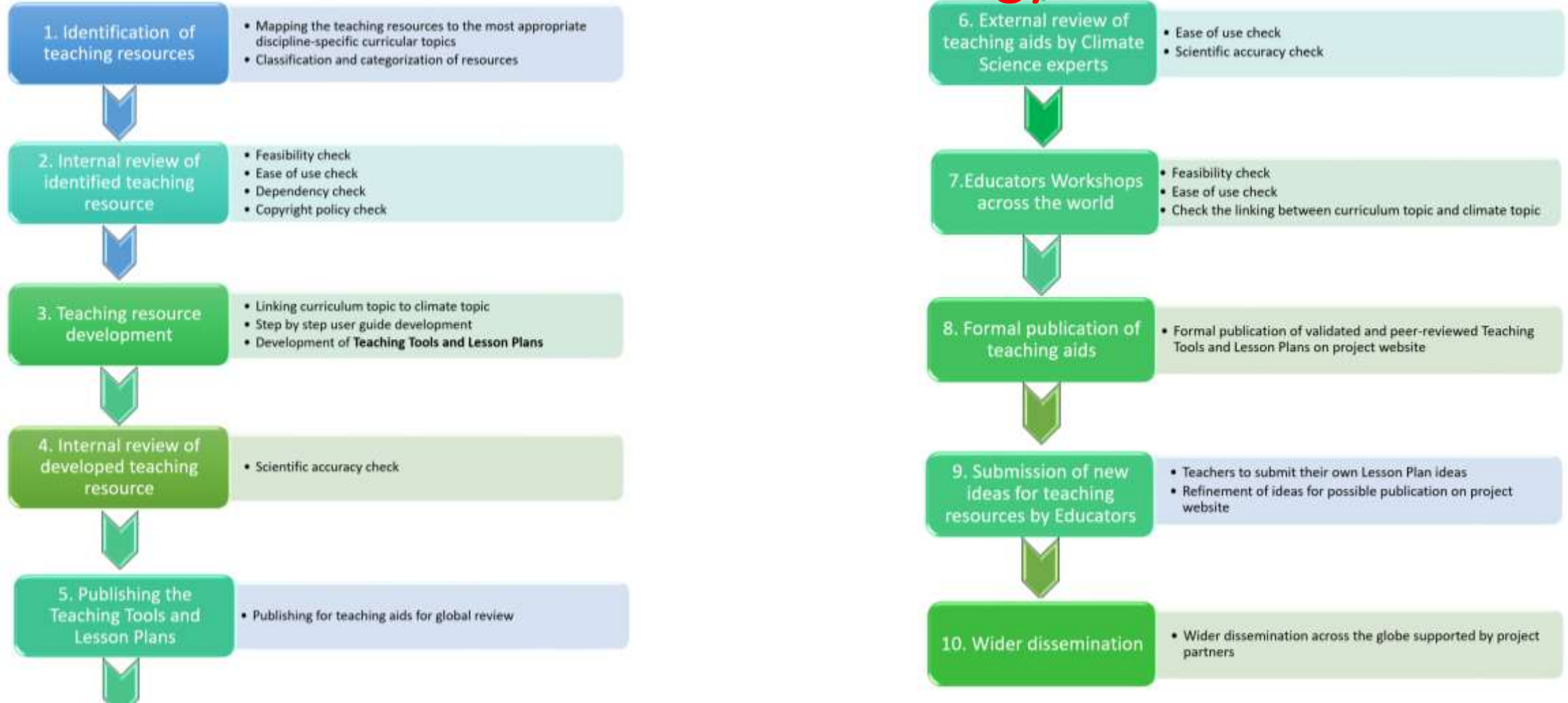
All educational resources are reviewed and validated by subject and educational experts before making it available for their use.



The TROP-ICSU Project



Detailed Methodology



Internal Review

Review by Climate Experts for Scientific Accuracy

Review by teachers for ease of use in classrooms



Approximately **300** EDUCATIONAL RESOURCES



For Teachers To
Integrate Climate Education With Curriculum Of

10 DISCIPLINES (as proof of concept)
Using Teaching Tools and Lesson Plans

Reviewed By

More Than **50** Climate Experts and
700 teachers from 10 different countries



SAMPLE TEACHING TOOLS FOR TEACHING TOPICS IN DISCIPLINES



Several computer-based reviewed teaching tools of different types that can be used to teach a topic in a given discipline with the help of a climate-related example

Teaching Tools categorized by Discipline, Tool Type, Climate Topic, Grade Level, Region, and Language.

DISCIPLINES:

1. GEOGRAPHY
2. BIOLOGICAL SCIENCES
3. CHEMISTRY
4. PHYSICS
5. EARTH SCIENCES
6. ENVIRONMENTAL SCIENCES
7. MATHEMATICS
8. STATISTICS
9. SOCIAL SCIENCES
10. ECONOMICS
11. HUMANITIES

TEACHING TOOL TYPES:

1. MODELS / SIMULATORS
2. VIZUALIZATIONS
3. CLASSROOM OR LABORATORY ACTIVITIES
4. VIDEO LECTURES
5. GAMES
6. AUDIO
7. READINGS
8. TEACHING MODULES



TROP ICSU EDUCATIONAL RESOURCES: LESSON PLANS



A Lesson Plan contains teaching resources and write-up describing how to teach a topic of science/mathematics/social sciences/humanities as part of a core curriculum using examples, case studies and exercises related to Climate Change

Step-by-step instructions provided, along with ways to evaluate teaching impact.



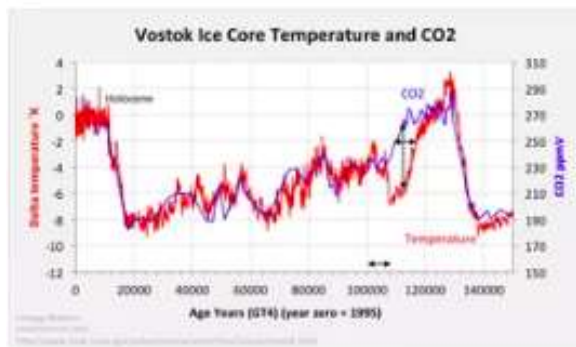


Lesson Plan: Atomic Number, Mass Number, Isotopes and Isotopic Ratios, and Isotopic Compositions as Climate Proxies

As a high school or undergraduate teacher of **Chemistry** or **Earth Sciences**, you can use this set of computer-based tools to help you in teaching atomic number, mass number, isotopes and isotopic ratios, the use of isotopic ratios to calculate temperature, and the use of isotopic composition to recreate past temperatures and climate. This lesson plan allows students to understand **isotopes**, **isotopic ratios**, **the relationship between isotopic compositions and temperature**, and how **isotopic compositions** are used to recreate past temperature and climate.

Thus, the use of this toolkit allows you to integrate the teaching of a climate science topic with a core topic in Chemistry or Earth Sciences.

VOSTOK ICE CORE TEMPERATURE AND CO₂

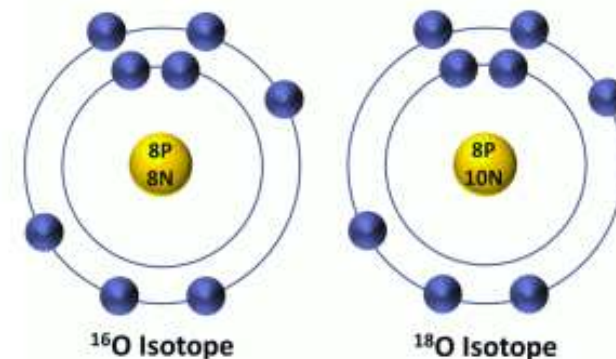


Questions

Use this lesson plan to help your students find answers to:

1. What is an isotope?
2. What is the relationship between isotopic compositions and temperature?
3. How can you use oxygen isotope data in an ice core to determine temperature?
4. How can you use isotopic compositions to reconstruct past climate?

Oxygen Isotopes





About Lesson Plan

| | |
|---------------------------|--|
| Grade Level | High School, Undergraduate |
| Discipline | Chemistry, Earth Sciences |
| Topic(s) in Discipline | <ul style="list-style-type: none">• Atomic Number, Mass Number• Isotopes and Isotopic Ratios• How isotopic ratios are used to calculate temperature• How isotopic composition is used to recreate past temperatures and climate |
| Climate Topic | Climate and the Cryosphere, Climate Variability Record |
| Location | Global |
| Languages | English (Simulation tool available in multiple languages) |
| Access | Online, Offline |
| Approximate Time Required | 130-150 min |

Contents

| | |
|---|---|
| Micro-lecture (video) (~10 min) | A micro-lecture that introduces the concepts of atomic number, mass number, and isotopes. https://www.khanacademy.org/science/chemistry/atomic-structure-and-properties/introduction-to-the-atom/v/atomic-number-mass-number-and-isotopes |
| Reading (20-30 min) | A reading about isotopic ratios, the relationship between isotopic compositions and temperature, and how isotopic compositions are used to recreate past temperature and climate. https://www.seas.harvard.edu/climate/eli/research/equable/isotopes |
| Classroom/Laboratory activity (~90 min) | A classroom/laboratory activity to recreate the climate of the last 50,000 years approximately using oxygen and hydrogen isotopic composition from ice cores from Antarctica. University of Washington Program on Climate Change: Laboratory Activity, From Isotopes to Temperature (Spruce Schoenemann, UW and Space Sciences) https://pcc.uw.edu/education/classroom-resources/climate-teaching-modules/uwhs-atms-211-from-isotopes-to-temperature-influence-of-orbital-forcing-on-ice-core-records/ |



Here is a step-by-step guide to using this lesson plan in the classroom/laboratory. We have suggested these steps as a possible plan of action. You may customize the lesson plan according to your preferences and requirements.

1. Introduce the topic through a micro-lecture (video)

- Discuss the components of an atom.
- Play the micro-lecture (video), "[Atomic number, mass number, and isotopes](#)", to introduce the concepts of atomic number, mass number, and isotopes. The video will help students understand the definitions of the terms through examples of hydrogen, carbon, and uranium isotopes.
- The video, "Atomic number, mass number, and isotopes" from Khan Academy is available at <https://www.khanacademy.org/science/chemistry/atomic-structure-and-properties/introduction-to-the-atom/v/atomic-number-mass-number-and-isotopes>
- Note: For a more detailed exploration of isotopes, atomic mass, and methods to calculate the average atomic mass, you may use the PhET simulation tool and associated activity listed in the Additional Resources section of this lesson plan. This activity will enable your students to calculate the average atomic mass of sample mixtures of isotopes by using various methods.

2. Discuss using an online reading

Next, read and discuss "[Isotope Analysis](#)" from Harvard University to introduce the occurrence and distribution of oxygen isotopes. Further, the reading will help your students understand isotopic ratios, the relationship between isotopic compositions and temperature, and how scientists can use isotopic compositions to recreate past temperature and climate. The reading, "Isotope Analysis" from Harvard University is available at <https://www.seas.harvard.edu/climate/eli/research/equable/isotope.html>

3. Conduct an activity using an interactive visualization

- Now, explore the relationship between isotopic compositions and climate through a hands-on classroom/laboratory activity, "From Isotopes to Temperature", created by Spruce Schoenemann, UW Earth and Space Sciences: In this activity, your students will analyze isotopic compositions of ice core data from Antarctica to infer past temperatures and climate. Students will plot graphs in MS Excel to perform data analysis and interpretation.
- Download the documents for the From Isotopes to Temperature Lab from <https://pcc.uw.edu/education/classroom-resources/climate-teaching-modules/uwhs-atms-211-from-isotopes-to-temperature-influences-of-orbital-forcing-on-ice-core-records/>.
 - Read the content in the PowerPoint Presentation (background information).
 - Download the files and conduct the activity described in Lab 1 of the module.



The TROP-ICSU Project



One small pedagogical innovation with multiple advantages

incorporates a multidisciplinary approach to teaching, leading to better educational outcome

introduces relevant Climate change topics to your classroom (a small effort without deviating from the curriculum/syllabus, but bringing major social shift)

use technology in the classroom

enhances learning outcome through location & language specific examples (this incentivizes teachers to use this approach)



Publications

Integrating Climate Change Education Across the Curriculum
in Resonance, 24(9), 1025-1028
<http://link.springer.com/article/10.1007/s12045-019-0865-6>



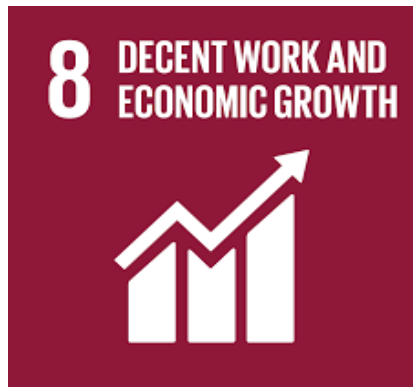
Educational strategies to achieve global awareness of Climate Change and its impact
in World Meteorological Organization e-library WMO Global Campus Innovations publication.

Climate Change Education Across The Curriculum in Climate Change and the Role of Education.
Eds. Leal Filho, Walter, Hemstock, Sarah L. Springer Series Climate Change Management.
<https://www.springer.com/gp/book/9783030328979>



The TROP-ICSU Project

TROP ICSU and SUSTAINABLE DEVELOPMENT GOALS (SDGs)



Project directly aligns with UN SDG 4 (Quality Education) and UN SDG 13 (Climate Action) and also with UN SDGs 8, 16, 17



**International
Science Council**



Partners

International Union of Biological Sciences IUBS

International Union for Quaternary Research INQUA

International Union of Soil Sciences IUSS

International Mathematical Union IMU

International Union of Geological Sciences IUGS

International Union of Geodesy and Geophysics IUGG

**International Union of History and Philosophy of Science and
Technology IUHPST**

International Union of Forest Research Organizations IUFRO

African Union of Conservationists AUC

IMAGINARY

Committee on Data for Science and Technology CODATA

International Council for Science- Regional Office for Africa



INQUA

International Union for Quaternary Research



**National academies of Australia, India,
Mongolia, South Africa, Ecuador & Egypt
World Climate Research Programme (WCRP)
World Meteorological Organization (WMO)
UN CC Learn and UNESCO**



TROP ICSU at the 4th UN STI Forum 2019, New York

<https://tropicsu.org/news-and-updates/trop-icsu-at-the-4th-un-sti-forum-2019-new-york/>



TROP ICSU participated in the Fourth annual Multi-stakeholder Forum on Science, Technology and Innovation for the SDGs New York, 14 – 15 May 2019 “Earth and Environmental Science Education for Sustainable Development”

TROP ICSU at the HLPF, UN Hq, New York

<https://sustainabledevelopment.un.org/index.php?page=view&type=20000&nr=5801&menu=14>

TROP ICSU participated at the United Nations High Level Political Forum 2019 (HLPF 2019) on Sustainable Development at the United Nations Headquarters on 11 July 2019

A three-hour joint session on "Practices and Approaches on quality education towards environment and climate action"



We invite you all to

- 1. Provide new educational resources to integrate climate change topics with the core curriculum*
- 2. To translate educational resources*
- 3. To disseminate the idea and the resources across the globe.*

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THANK YOU