

# Imagining a Local University in the Age of Global Warming

A Thought Experiment  
Vikram Vyas

Dr. Mohan Singh Mehta Memorial Lecture, Udaipur, 22 April 2022

# Prelude (प्रस्तावना )

**Human civilisation is in an existential (अस्तित्व) crisis**

- Global warming which will change the nature of the human civilisation, with majority of poor and underprivileged paying for the excess of privileged few.
- Our education institutions, and other major institutions, largely continue to function as if global warming is an abstract problem of the future.
- Declining jobs for young people, with many professional jobs are likely to be replaced by artificial intelligence.

# Thanks

## An opportunity for a thought experiment (चिंतन प्रयोग)

- I am very grateful to the organisers of Dr. Mohan Singh Mehta memorial lecture, in particular to Ajay Mehta, for giving me an opportunity to share with you a “thought experiment” in which I will describe the broad contours of a small, local university which can respond to these three causes of despair with which I started with.
  - In the spirit of a thought experiment, I will focus on the conceptual heart of such an imaginary university while ignoring many essential details.
  - My aim is not to provide a detailed map of such an university but to emphasise the need for such a university.

# The Origin

## Where am I coming from?

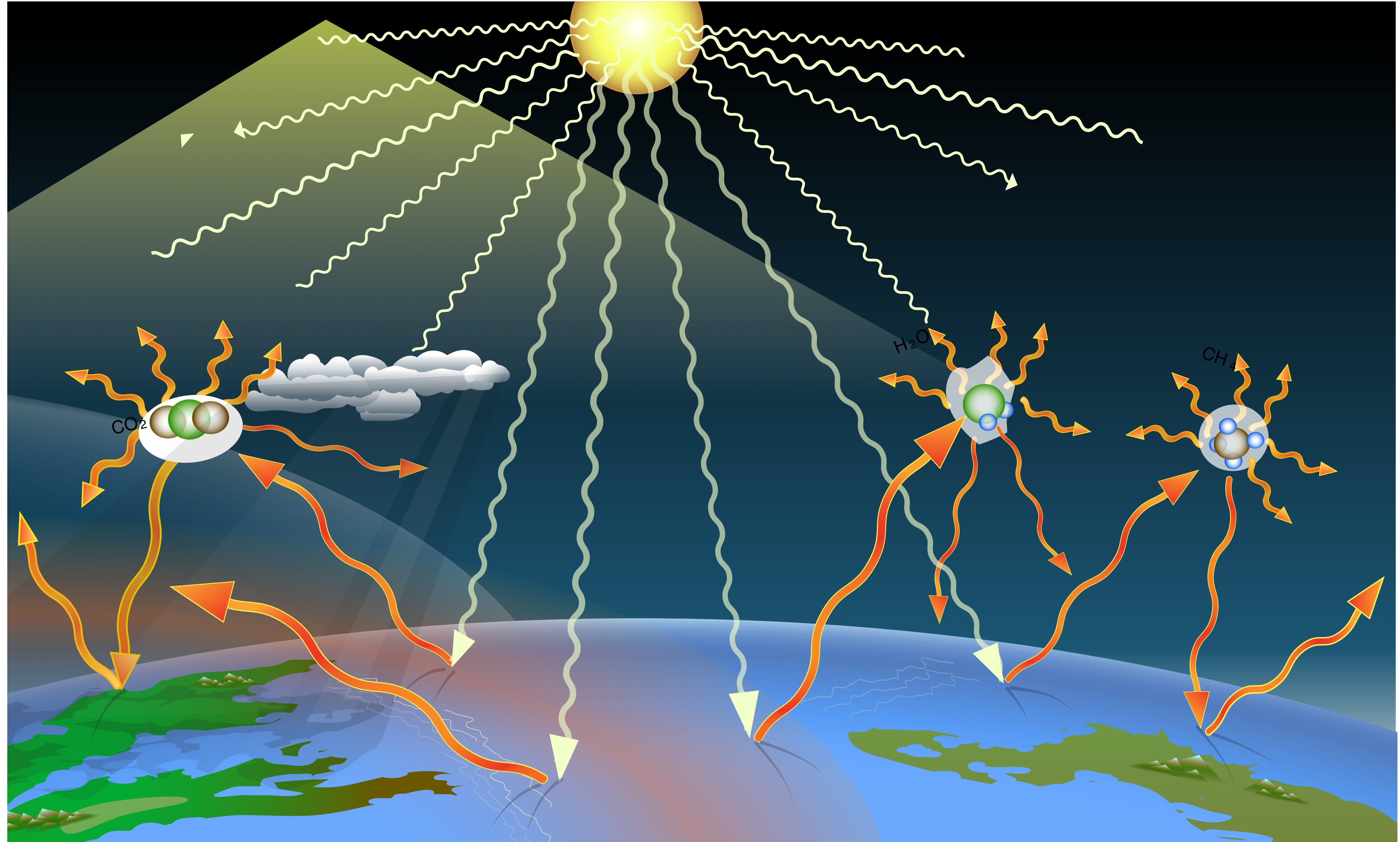
- My thoughts about these issues have been informed, influenced and coloured by my experience as a physics teacher in public and private universities.
- My experience of working with undergraduate physics students in Bikaner has been particularly critical in the evolution of my thinking:
  - Many of these students had come from villages near Bikaner and were the first college going members of their family.

# Outline

1. A brief introduction to the physics of global warming.
2. Why a small university?
3. Why local ? Local in what sense?
4. The architecture of the university.
5. Curriculum of the university: Teaching in the age of global warming.
6. Three “impossible” things: No accreditation, no degree, no tuition fee.
7. Saying the unsayable: The spiritual and the moral compass of the university.

**What is global warming?**

# Green House Effect



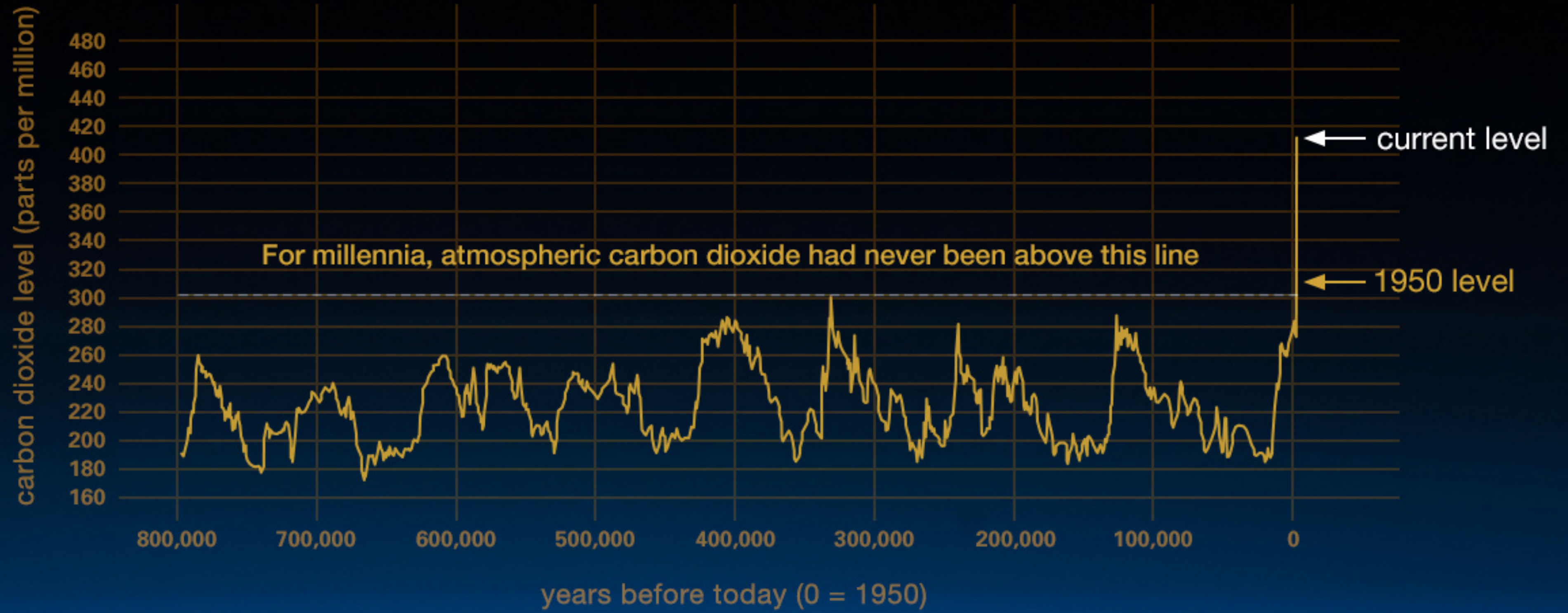
Credit: [A loose necktie](#) on Wikimedia Commons

# The Greenhouse Effect

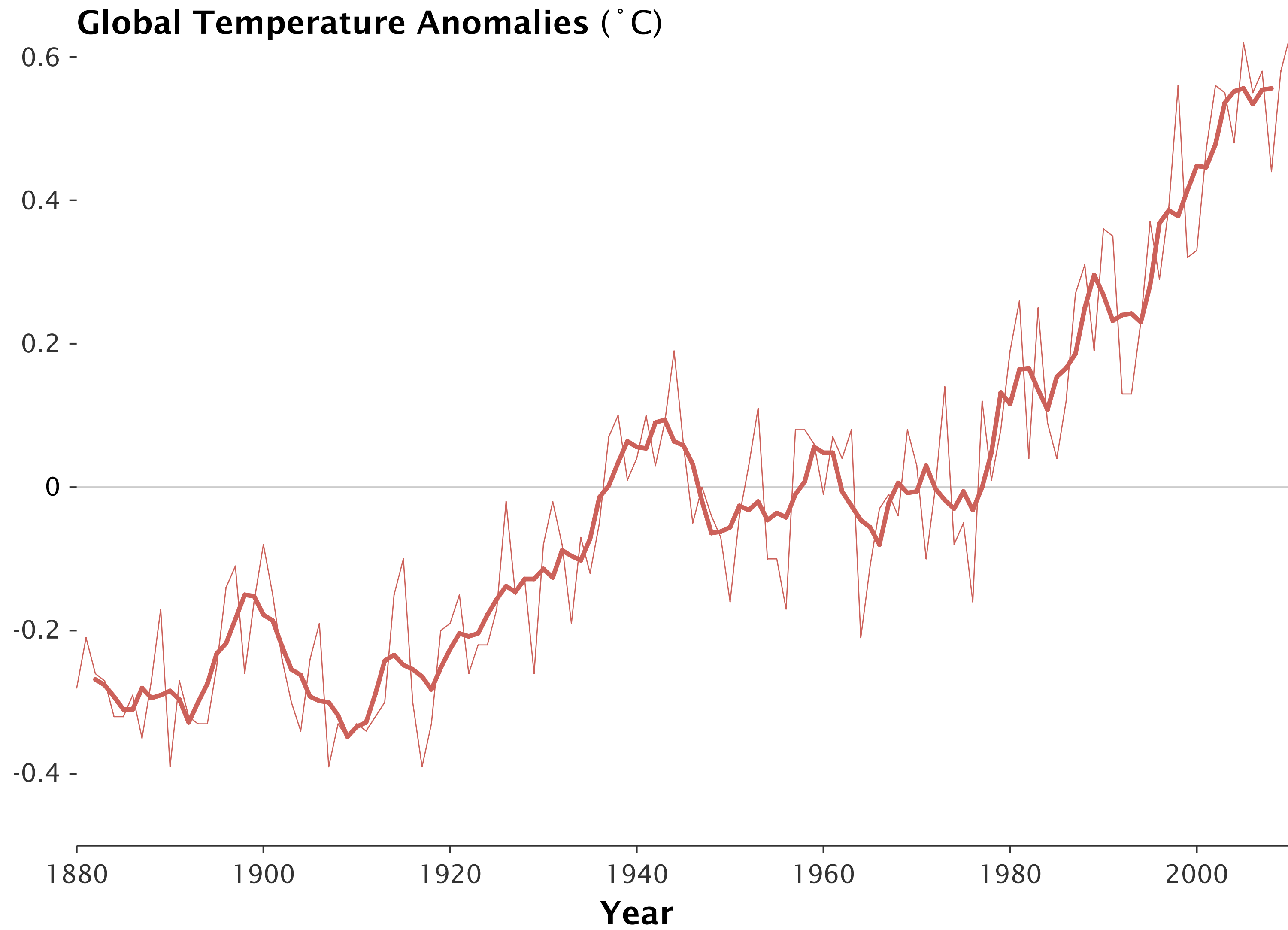


Atmosphere

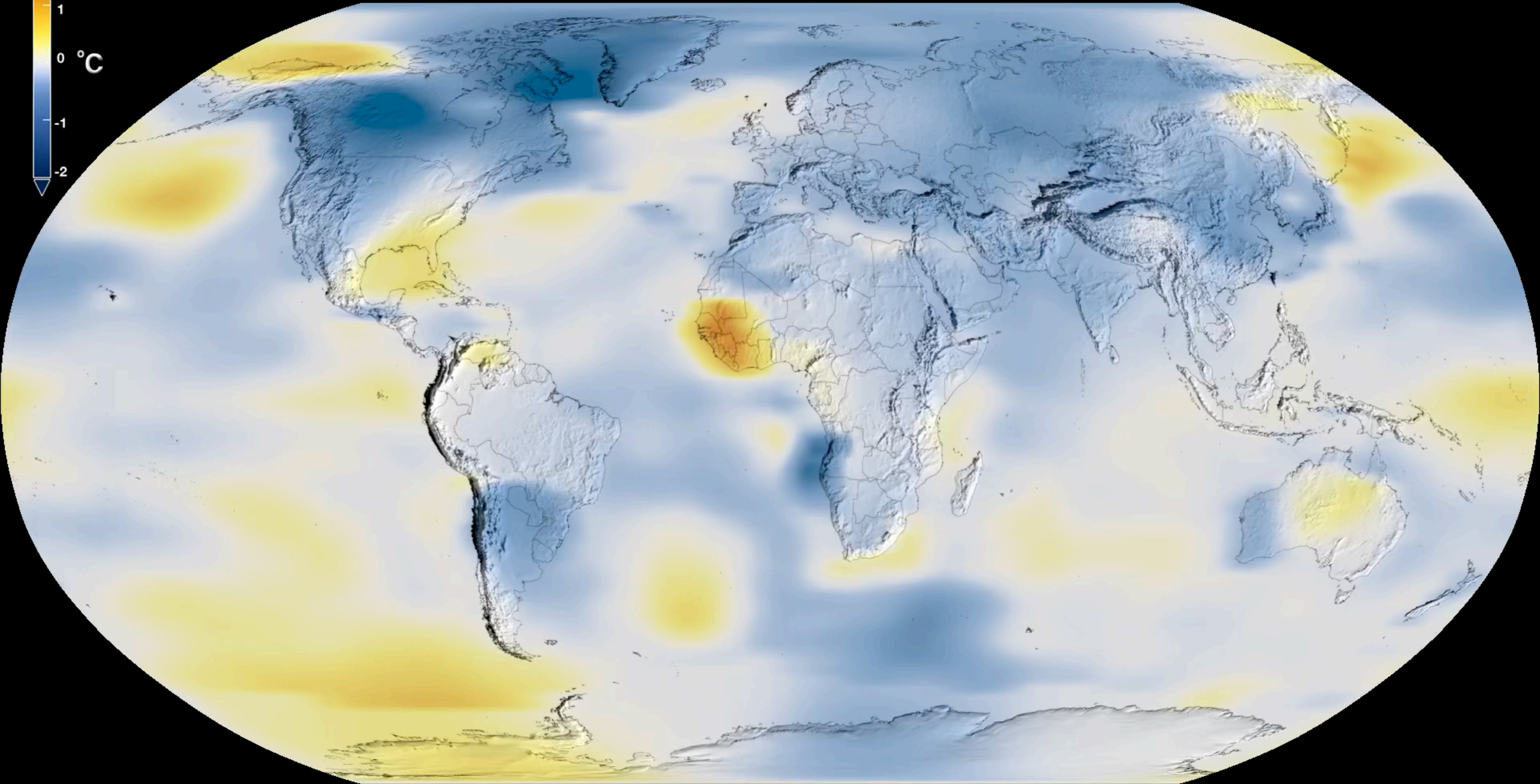
[climate.nasa.gov](http://climate.nasa.gov)



# Rise in average global temperature



1880 - 1884



# Some consequences of global warming for India

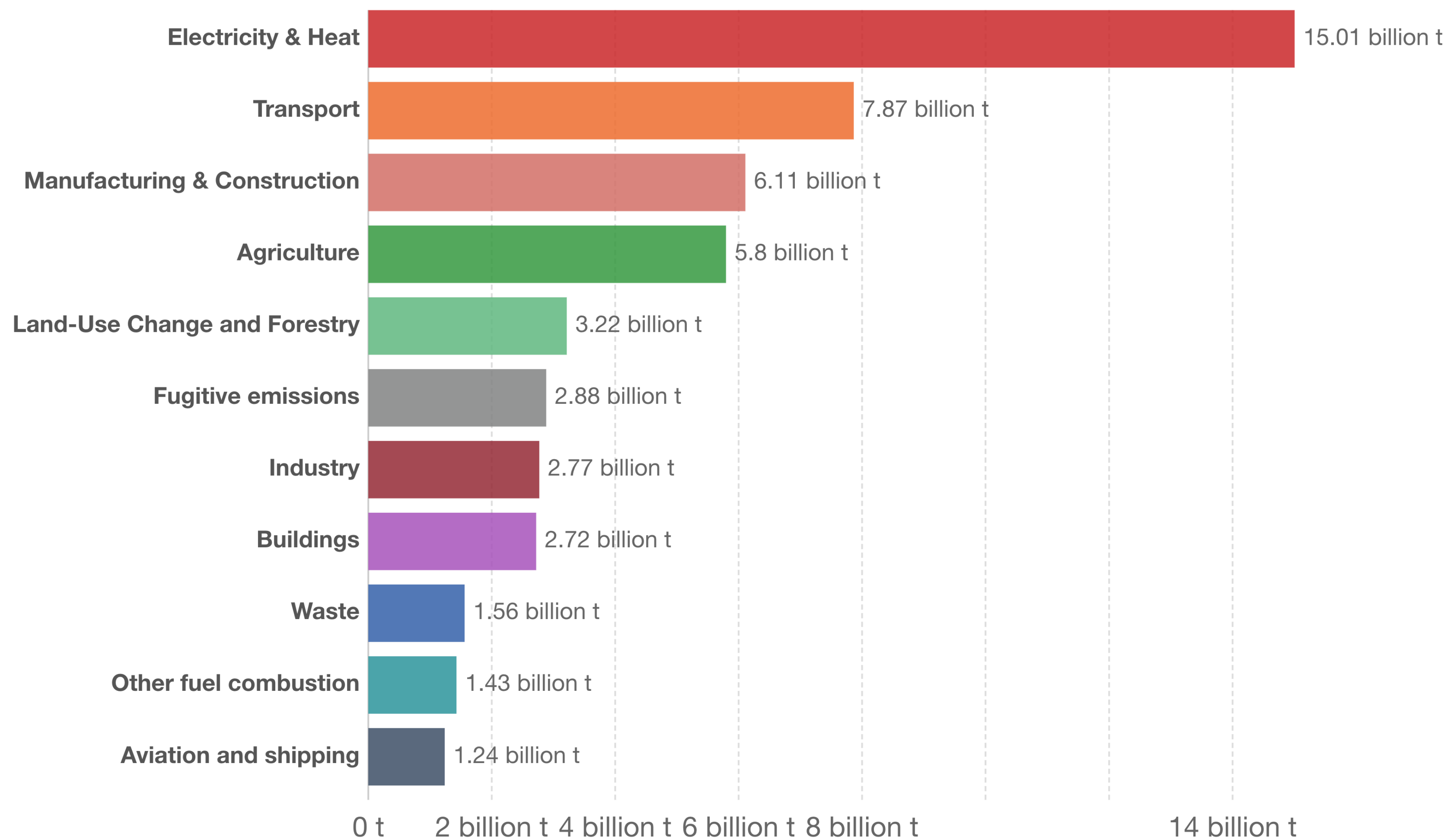
**“We find a significant relationship between heat waves and deficits in precipitation. Results show that concurrent heat waves and droughts are projected to increase in most places in India during the twenty-first century. ”**

**P. Kishore, Ghouse Basha, M. Venkat Ratnam, Amir AghaKouchak, Qiaohong Sun, Isabella Velicogna & T. B. J. M. Ouarda**

**[www.nature.com/scientificreports](http://www.nature.com/scientificreports)**

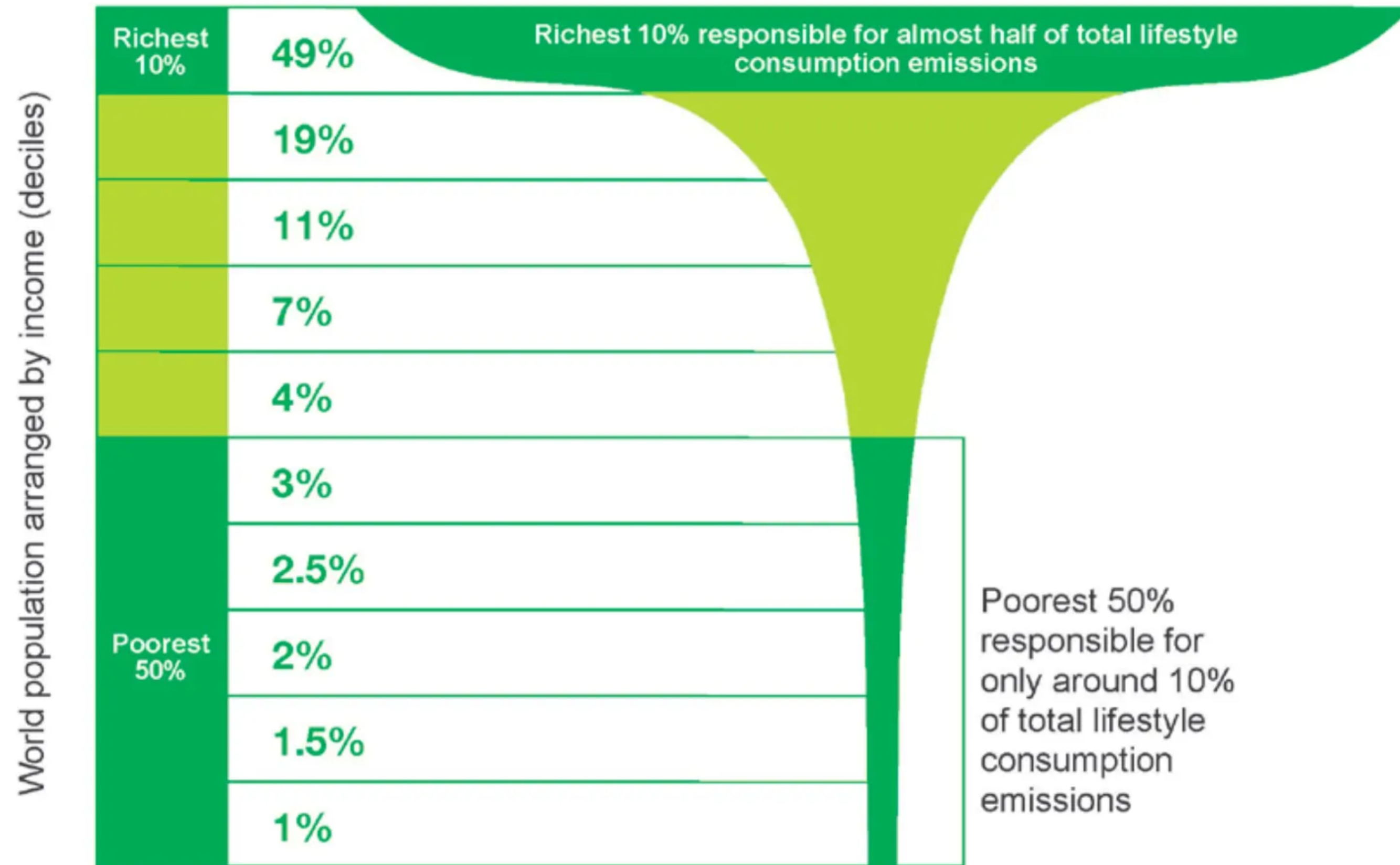
# Greenhouse gas emissions by sector, World, 2016

Greenhouse gas emissions are measured in tonnes of carbon dioxide-equivalents (CO<sub>2</sub>e).



# Wealth and Global Warming

Percentage of CO<sub>2</sub> emissions by world population



**Why a small university?**

# Why a small university?

## Make a small footprint on the land and the environment

- A piece of land has a finite carrying capacity.
  - If we want to meet our energy and water needs locally and sustainably then we have to think of a small university.
  - I envision a university of around twenty faculty and staff members.
  - Enrolling around hundred students every year.

# Why a small university?

## Richard P. Feynman's forward to "Lectures in Physics"

"I think, however, that there isn't any solution to this problem of education other than to realise that the best teaching can be done only when there is a direct individual relationship between a student and a good teacher—a situation in which the student discusses the ideas, thinks about the things, and talks about the things. It's impossible to learn very much by simply sitting in a lecture, or even by simply doing problems that are assigned. But in our modern times we have so many students to teach that we have to try to find some substitute for the ideal. Perhaps my lectures can make some contribution. *Perhaps in some small place* where there are individual teachers and students, they may get some inspiration or some ideas from the lectures. Perhaps they will have fun thinking them through—or going on to develop some of the ideas further."

**Why local?**

**And local in what sense?**

# Local in what sense?

**An institution meant for the local community and supported by them**

- A university connected to the local community
  - No boundary physical or otherwise separating the university from its neighbours.
  - Its mode of learning, its architecture is cognisant (अवगत) of the place where it is situated.

# Why local?

**Local (स्थानीय) but not parochial (संकीर्ण)**

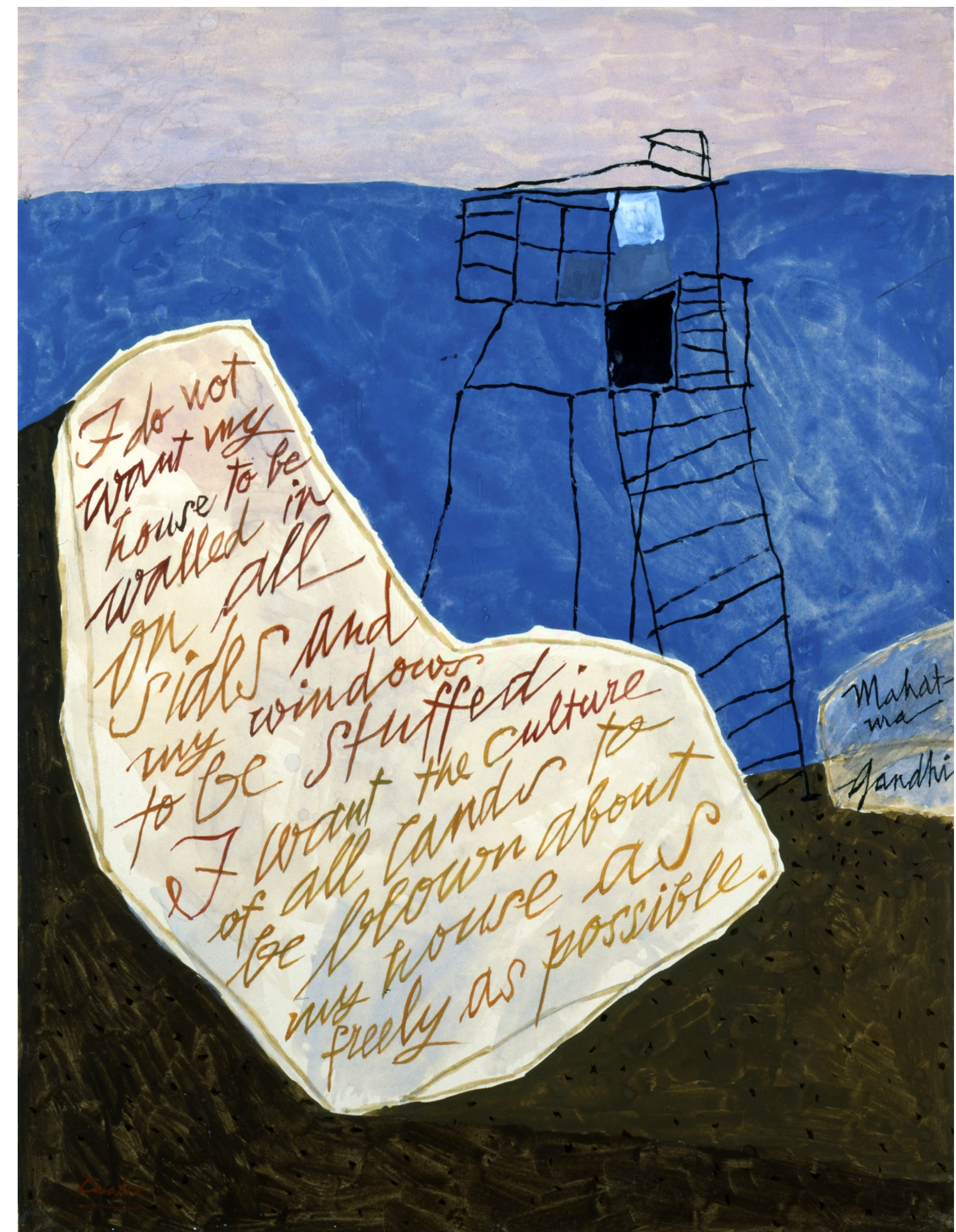
- To remove the alienation (अलगाव की भावना) that many young people feel when entering a university.
- A local university that is aware of local power hierarchies, in particular of the caste system, has culture and a moral compass to challenge such unjust institutions.

# Why local and local in what sense?

“I do not want my house to be walled in on all sides and my windows to be stuffed. I want the cultures of all lands to be blown about my house as freely as possible. But I refuse to be blown off my feet by any.”

**M. K. Gandhi**

- A university that builds bridges between the local and the global
- Establishing dialog with other institutions of learning from all over the world.
- A part of network of local universities sharing academic and physical resources.



Hans Laabs, "I do not want my house to be walled in on all sides and my windows to be stuffed. I want the culture of all lands to be blown about my house as freely as possible."-- Mahatma Gandhi, Young India, June 1, 1921. From the series Great Ideas of Eastern Man., 1964, gouache on paper mounted on paper, Smithsonian American Art Museum, Gift of Container Corporation of America, 1984.124.167

# The architecture of the university

# The architecture of the university.

## The grand academic institution

- A building that marks the grandeur of the institution.



Louis Kahn Plaza, IIM Ahmedabad

# The architecture of the university.

Buildings that reflect the small local nature of the university

- Buildings that don't dominate the landscape but merge into it



Source: [kerearchitecture.com](http://kerearchitecture.com)

Exterior view of Goethe Institute Senegal. Render by Kéré Architecture.

# The architecture of the university.

## An architect for our times

“Less energy is good for the world and that is important in my structures wherever possible,”

"I try to see what is locally most available so that I can use it in a building. I try to minimise our costs in terms of material costs, because the construction sector is one of the highest burdens for climate change, and the crisis that we have."



Diébédo Francis Kéré (born 10 April 1965) is a Burkinabé (Burkina Faso) architect, recognized for creating innovative works that are often sustainable and collaborative in nature.

**Source: wikipedia**

# The architecture of the university.

## Building using local materials

“The campus is built out of locally sourced quarry stone with a plaster finish. In choosing which materials and construction techniques to use, ecological sustainability, cost and availability factors were weighed to arrive at the best compromise. Collaboration with the local community was key in this decision-making process, drawing from their experience and expertise. “



**Source: [kerearchitecture.com](http://kerearchitecture.com)**

Entrance of Startup Lions Campus. Photo by Kinan Deeb for Kéré Architecture.

# The architecture of the university.

## Green and comfortable building

“Although the classrooms need mechanical air conditioning because of the IT equipment, the massive clay walls contribute significantly to cooling down the interior spaces.”



Source: [kerearchitecture.com](http://kerearchitecture.com)

Veranda of the Burkina Institute of Technology (BIT). Photo by Jaime Herraiz for Kéré Architecture.

# The architecture of the university.

## A locus of innovation

"I did a modern building that is not westernised, and not a traditional African building, ... to create a building that responded the best to the need of the climate and the need of the people, using the most available material".



Gando Primary School. Photo by Simeon Duchoud.



Gando Primary School Extension. Photo by Erik-Jan Ouwerkerk.

“The building benefits from the lessons learnt and skills acquired by community members in the construction of the Gando Primary School. It is built out of the same materials and following similar construction techniques, but features notable upgrades, such as its vaulted ceiling. “

**Source: [kerearchitecture.com](http://kerearchitecture.com)**

# Curriculum of the university: Teaching in the age of global warming

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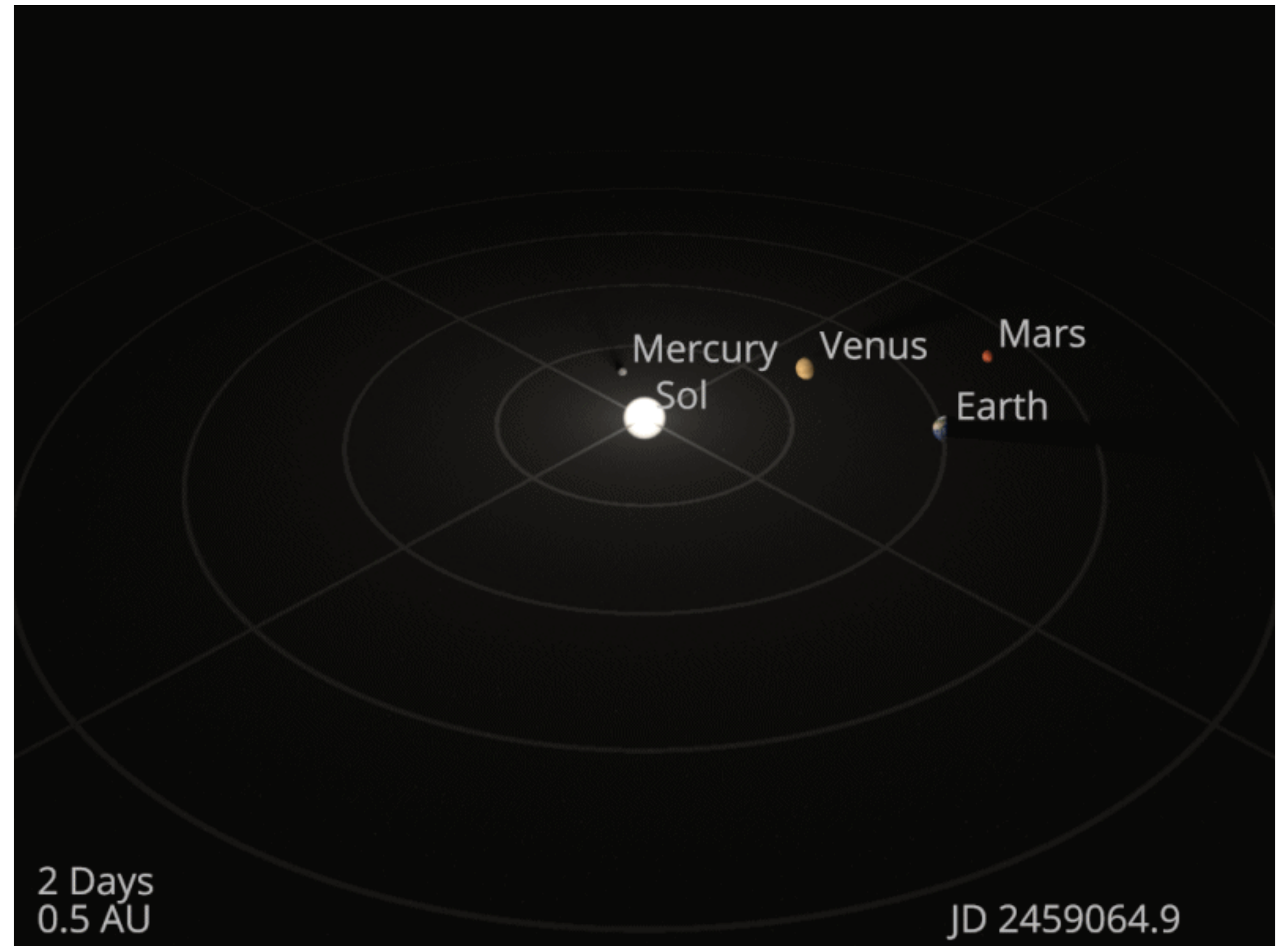
## A viewpoint from teaching physics

- How do we teach our students the interconnectedness of different phenomena when pedagogy requires us to insolate and simplify a phenomena?
  - Supplement class room lectures with long term projects
    - Detailed investigations using mathematical modelling
    - Rigorous and quantitative
    - Connecting what they observe with what they learn

# Teaching in the age of global warming

## The night sky as taught

- A beginning physics undergraduate is taught how to calculate the motion of a planet around the sun. The view she develops is:



Source: wikipedia

# Teaching in the age of global warming

## The night sky as seen

- When we look at the night sky, the view is very different from the view we learn and calculate in the classroom

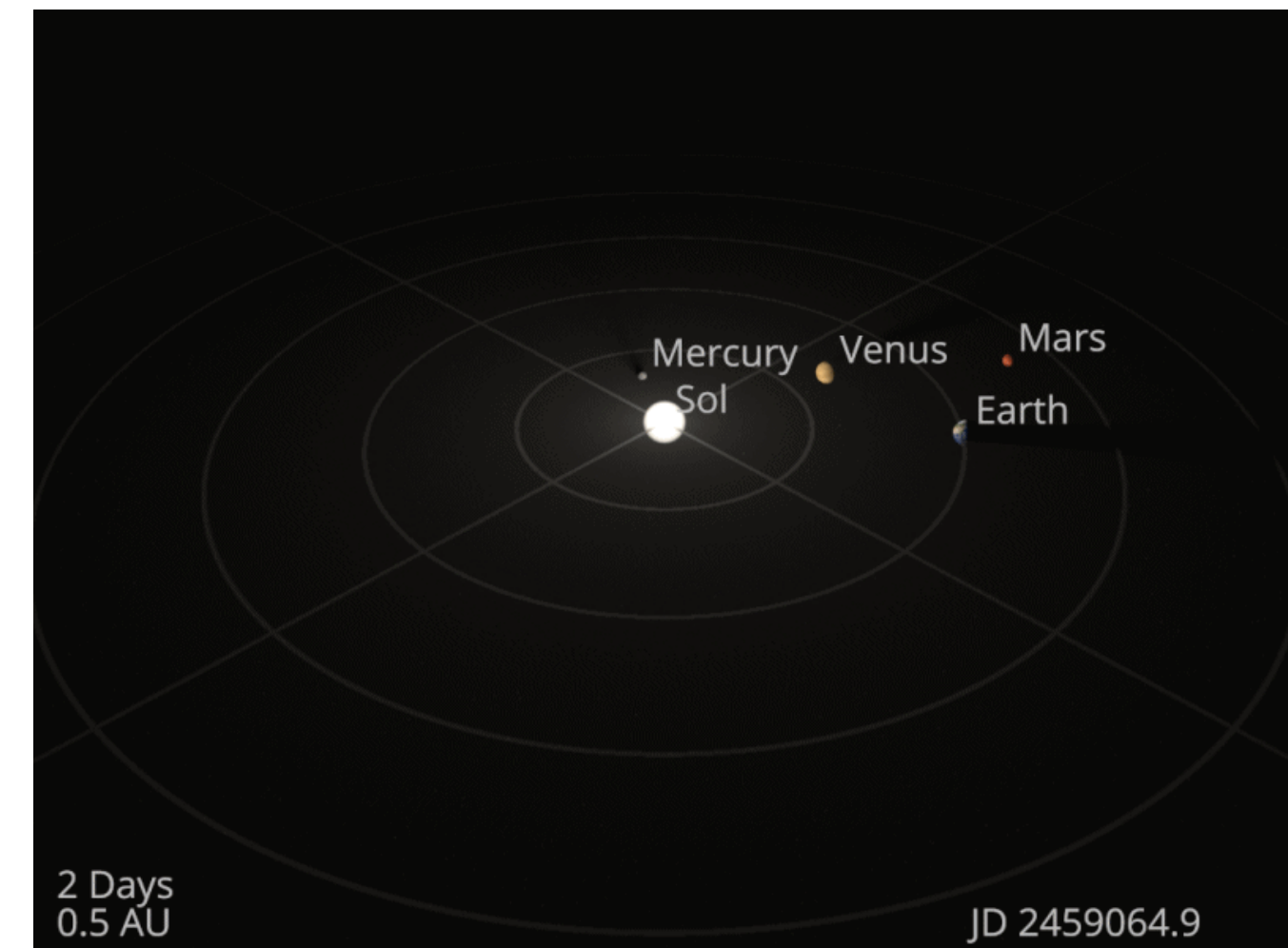


Source: [earthsky.org](http://earthsky.org)

# Teaching in the age of global warming

## Reconciling these two views

- Obtaining the heliocentric view (the first view) from the observation of night sky took human civilisations thousands of years, culminating in Newtonian revolution and the beginning of modern physics.
- A student can experience this whole process using mathematical modelling and local observations as a part of a year long project.
  - Resulting in a deeper appreciation of the beauty of the night sky.
  - An appreciation of the power of laws of nature as we understand them.
  - Developing powerful skills in mathematical modelling and computer programming.



# Teaching in the age of global warming

## Understanding local water bodies

- Understanding local water bodies is not a problem of physical sciences alone.
- It is a complex locus of science, sociology, environment, history, local governance ...
- Understanding it can be an effective way of making a student appreciate many aspects that will go in developing sustainable way of living.
- It can be a part of two year long project for students



Source:

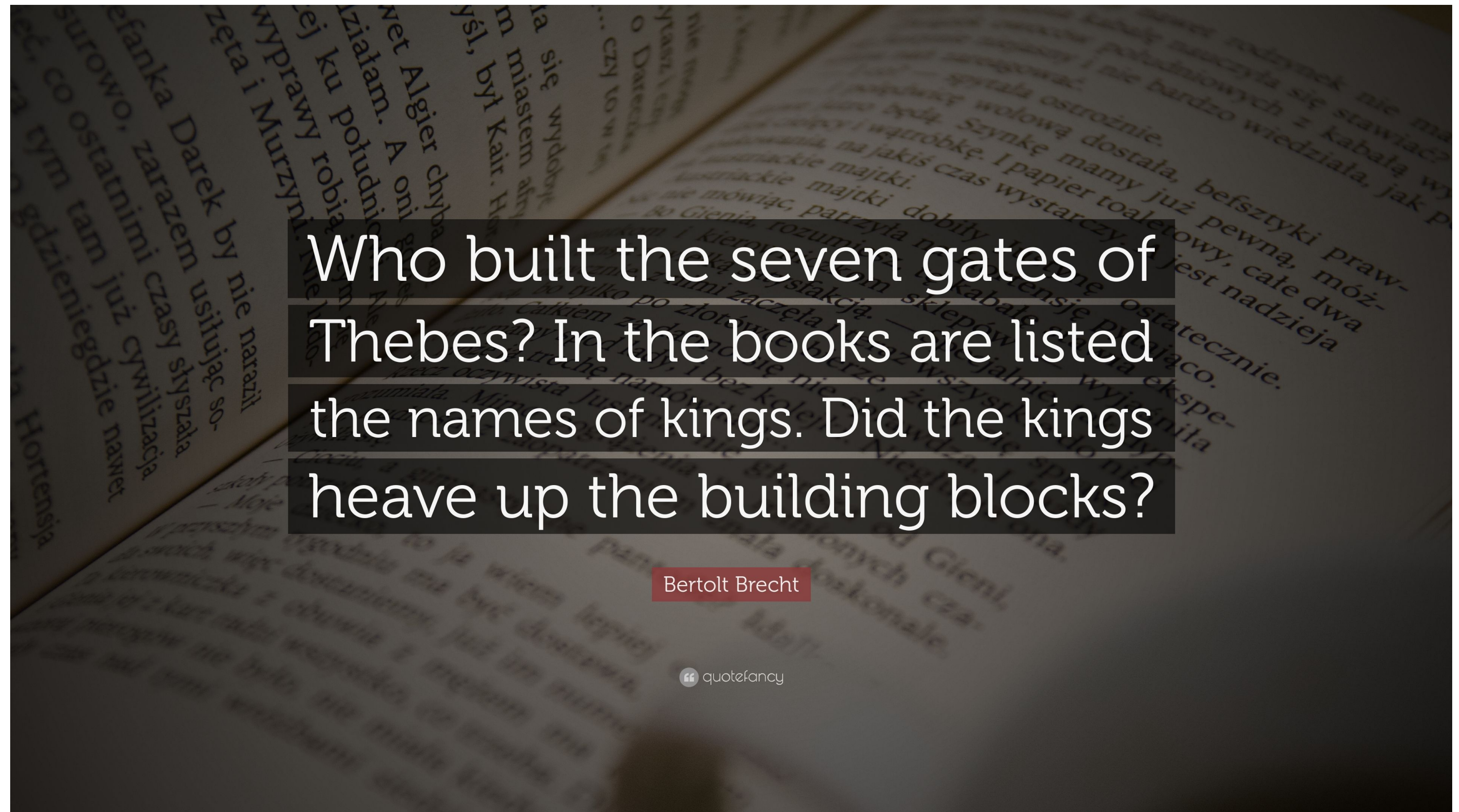
जल और समाज किताब से साभार, ब्रजरतन जोशी

# Teaching in the age of global warming

## Understanding local water bodies

- Physics and hydrology of a Talab
  - Develop a model that predicts the amount of water in the talab as a function of historical records of rainfall.
  - An opportunity to use methods of neural networks and deep learning (AI) for an important problem that all communities will face.

## Who built the Talab?



Three “impossible” things: No accreditation, no degree, no tuition fee

# Two “impossible” things

## No accreditation no degree

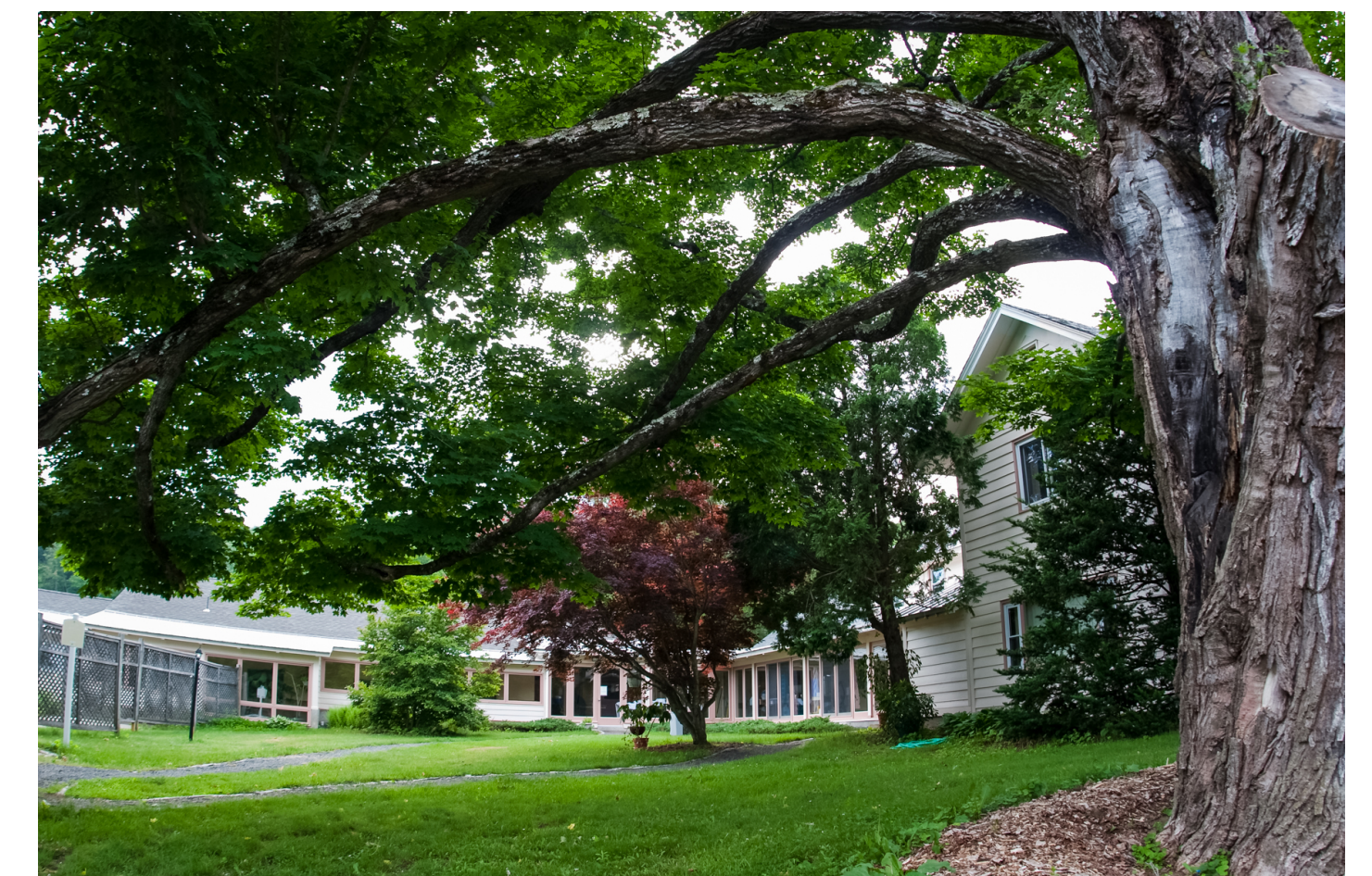
- With innovative and flexible ways in which the university will have to respond to the crisis of global warming and declining employment opportunities, it will be difficult to fit its academic program into a predefined concept of a degree and what should be taught.
- The value of such a university is not in any degree it could offer but in developing a rigorous academic program tailored individually for a student to meet her aspirations and skills.
- The credential of such a university will only be the quality of education it imparts to the graduating student.

# “Impossible” thing

**No tuition fee: A different model for developing and running an university**

**Vipassana meditation centre model** “All models are wrong, but some are useful”

“All courses at the Vipassana Meditation Center are run solely on a donation basis. Donations are accepted only from students who have completed at least one ten-day course with S.N. Goenka or one of his assisting teachers and have experienced for themselves the benefits of Vipassana. Thus Vipassana is offered free from commercialism.”



**Source: [dhamma.org](http://dhamma.org)**

# An “impossible” university

## Building and running such an university

- Follow the spirit of Vipassana meditation centres.
- Seek small annual donations from a very large number of stake holders.
- Seek contribution in running and maintaining the university.
- A different kind of “crowd source” funding.

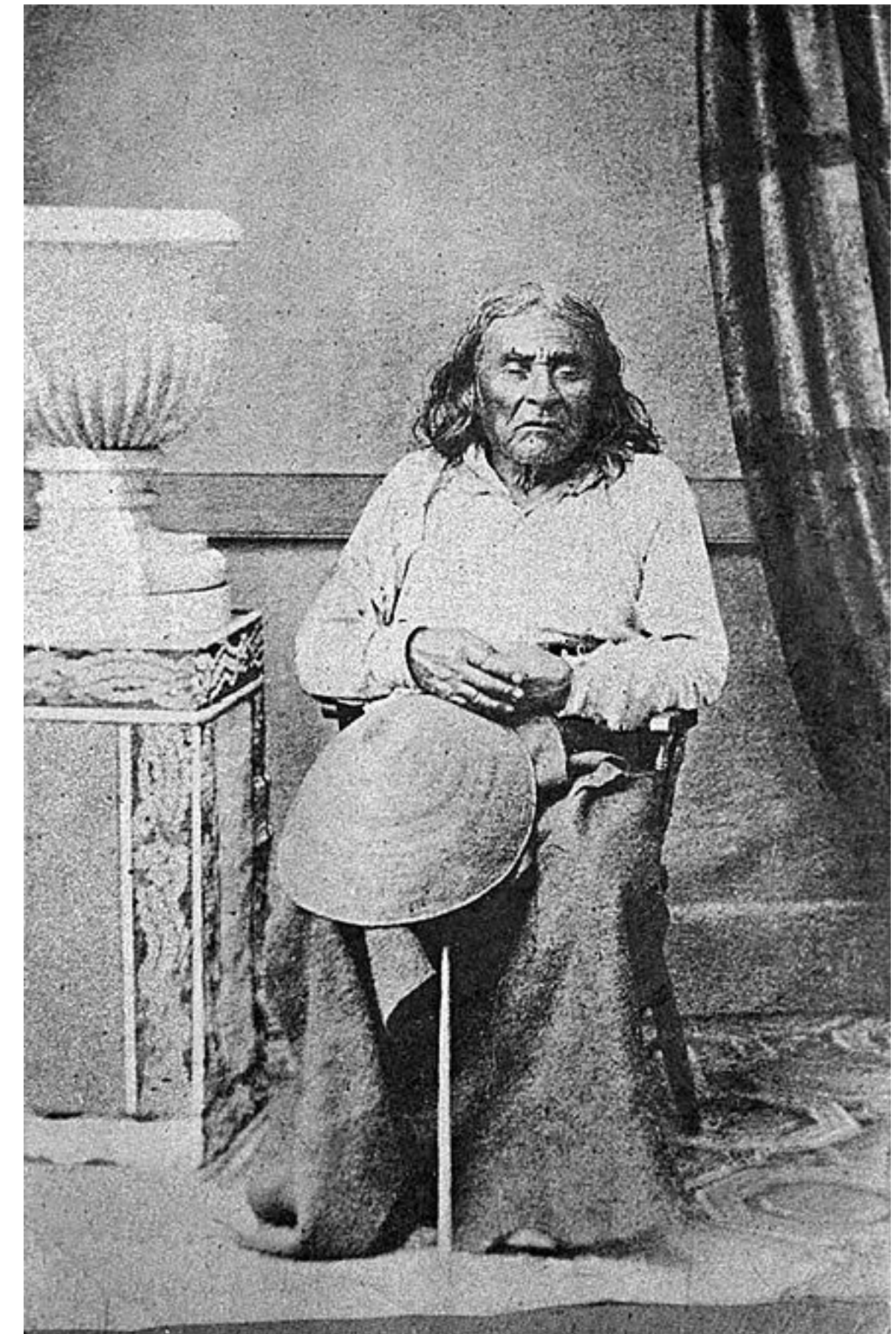
**Saying the unsayable: The  
spiritual and the moral compass  
of the university.**

# The spiritual and the moral compass

Things you cannot teach but can hope to learn

“This we know: All things are connected. Whatever befalls the earth befalls the sons of the earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself. ”

Chief Seattle's speech, 1854



Source: wikipedia

# The spiritual and the moral compass

Things you cannot teach but can hope to learn

“वैष्णव जन तो तेने कहिये  
जे पीड परायी जाणे रे ।  
पर दुःखे उपकार करे तो ये  
मन अभिमान न आणे रे ॥ ”

Narsinh Mehta

**Thank you**