

4DEE's Role in Improving an Online Module for Teaching Tropical Ecology and Conservation

V. Jithin

Nature Conservation Foundation, India
Education Scholar, OCELOTS

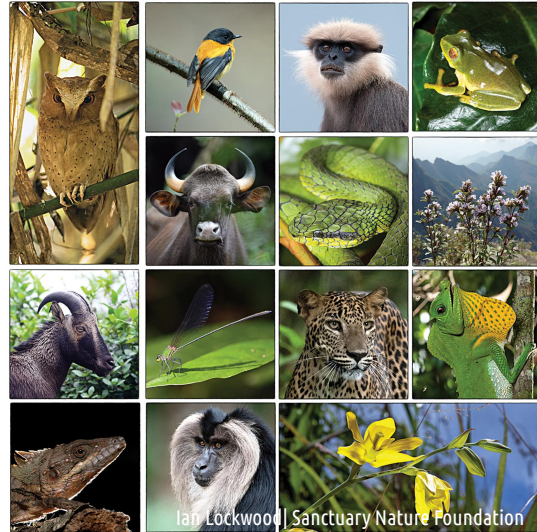
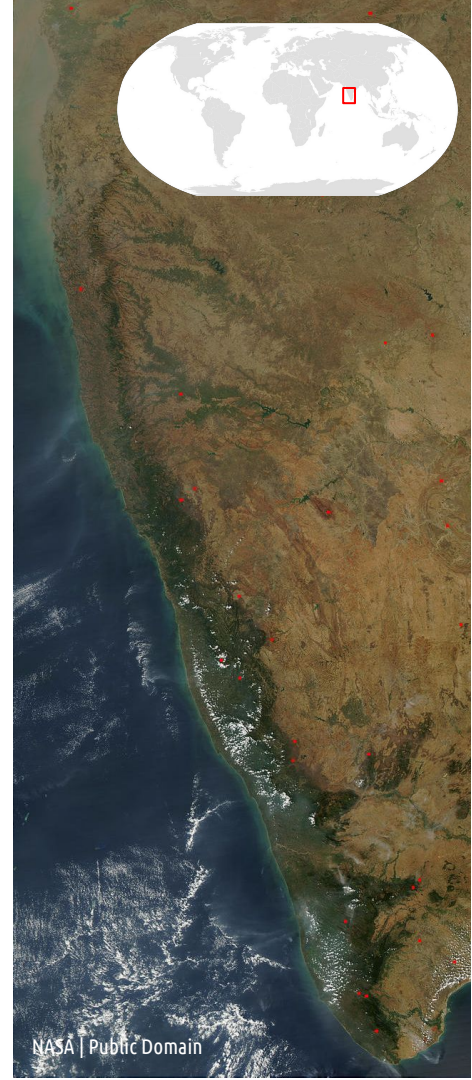


**nature
conservation
foundation**



From where am I?

- 'Western Ghats & Sri Lanka', one of the eight 'hottest' global biodiversity hotspots.
- Face significant pressure from high human population densities.



What was the module about?

- Rock outcrops in the northern Western Ghats are home to multiple threatened, endemic species.
- Culturally, geologically and historically important landscape.



'Sada's of Konkan
Ratnagiri, Western India

What was the module about?

- Rock outcrops, such as this **lateritic plateaus** harbour multiple **microhabitats** including loose rocks and rock pools.
- Unprotected land, classified officially as **'wastelands'** in the Government records, threatened by rapid land-use changes.



Madhusudan and Vanak, 2022; Watve, 2013



Changing rock outcrops in the northern Western Ghats

Agricultural land-use change to **traditional rice paddy cultivation**. Most paddy fields are now **abandoned** due to poor income and unpredictable weather patterns.



Changing rock outcrops in the northern Western Ghats

Mango and cashew orchards are **expanding**, fetching higher prices in the market; received Geographic Indication tag.



What was the module about?

- **Study** on the rock-dwelling animals living under the loose rocks, across undisturbed plateaus, abandoned paddy fields and orchards.
- Found **large rocks** were mostly moved to the paddy fields, animal **community composition** is affected, while **negatively** impacting a threatened, endemic gecko, a generalist viper, but **positively** impacting an endemic caecilian.

7179 rocks

5738 individuals

38 taxonomic groups



Supported by:



BOMBAY ENVIRONMENTAL
BEAG
ACTION GROUP



Transformation to an online teaching module - The journey

- The Online Content for Experiential Learning of Tropical Systems Network - tropical ecology researchers, active learning pedagogy, software and media specialists.
- Open-access, online, innovative, interactive.
- Spark excitement, broaden cultural and geographic perspectives, principle-based reasoning and quantitative skills in ecology.
- OCELOTS-BioQUEST/QUBES Fall 2023 incubator.
- Team of mentors, best teaching and learning practices, interactive data tools; bi-weekly virtual sessions.



The 'complicatedness'

Traditional
agriculture and
abandonment

Poorly studied
ecosystem,
microhabitats
& animal
ecology

Snakebites
in the
landscape

Community
based
conservation -
Biodiversity
Heritage Site

To **restore** the
abandoned
paddy habitats
or not?

Threatened
endemic
organisms

Recent
agroforestry
practices, high
demand,
economic value

Newly
announced
developmental
projects and
public outrage

Relatively
simple survey
methodology

Study on the
land-use
change impact

Cultural value -
Geoglyphs

Human-
nature
relationship

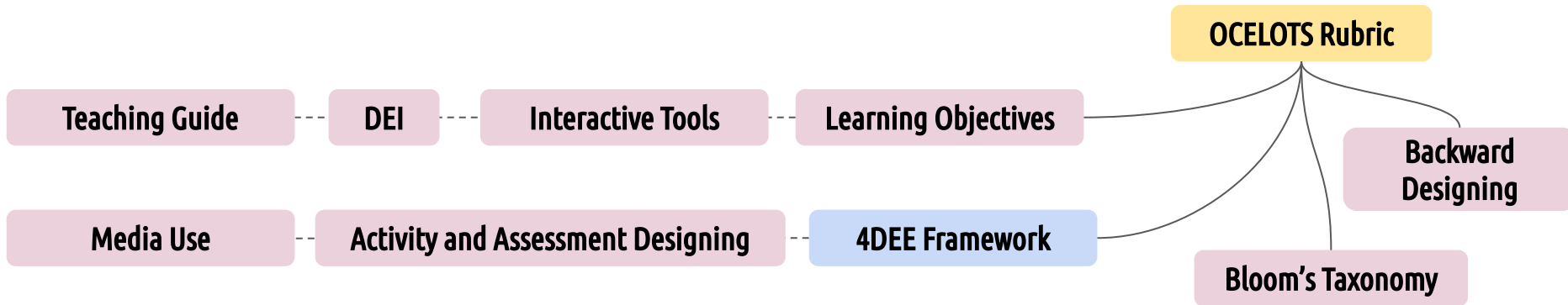
Context
specificity
of animal
response

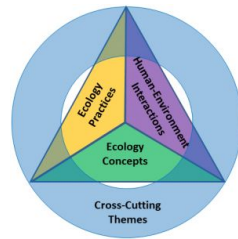
Wasteland
status of
the habitat
- **policy**

etc.

What to tell, and what not?

- The 'raw', **complicated** conservation scenario + understanding of ecological data interpretation, while teaching.
- Should I focus on the study design, ecological data, its interpretation and statistical analysis?
- To what extent the human-nature relationship, and research ethics need to be explored?





Role of 4DEE in the module development

Ecology Concepts	Ecology Practices	Human-Environmental Interactions	Cross-cutting themes
<ul style="list-style-type: none"> ● Organisms (eg. Habitat and niche, abiotic and biotic features of the environment) ● Community (eg. Habitat types, species diversity) 	<ul style="list-style-type: none"> ● Quantitative reasoning and computational thinking ● Designing and critiquing investigations ● Communicating and applying ecology 	<ul style="list-style-type: none"> ● Human dependence on environment ● Human accelerated environmental change ● How humans shape and manage resources/ environment ● Ethics 	<ul style="list-style-type: none"> ● Structure & Function ● Spatial scale ● Endemism

Role of 4DEE in the module development

- Human-environmental interactions as detailed chapters.
- Intentional placing of ecological findings in the complex decision-making.
- Critical thinking based assessment.



Between a rock and a hard place

What can turning rocks tell us about land-use change impacts on animals living in a rock outcrop?

Vijayan Jithin and Aparna Watve •••

Let's look under some boulders in a biodiversity hotspot in western India to discover the impact of habitat change on threatened animals.

The tropics are undergoing large-scale land-use change, especially for the purpose of meeting agricultural requirements. Understanding how this impacts biodiversity is important, especially in under-appreciated open ecosystems such as rock outcrops, home for many threatened species. We will evaluate how the movement of large rocks from the natural rock outcrops for rice paddy cultivation and subsequent changes

TABLE OF CONTENTS

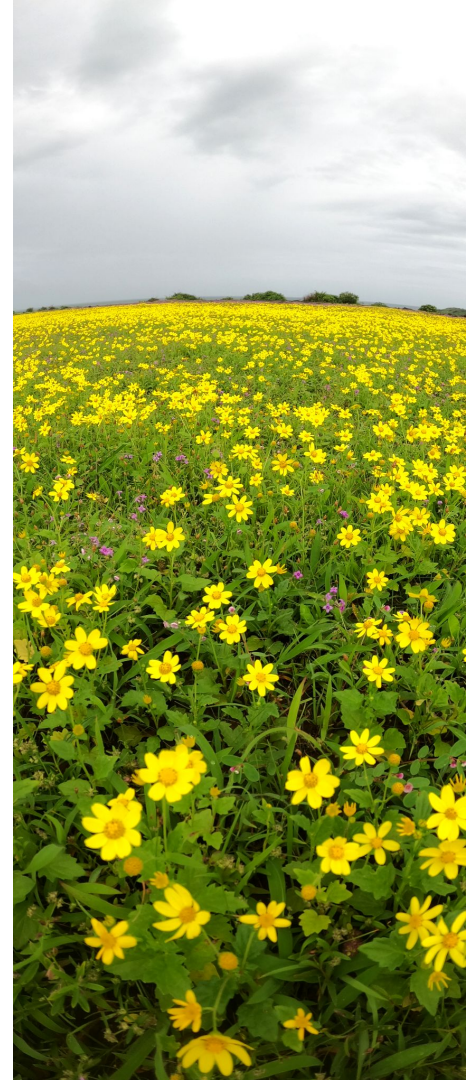
- 1 Rock Outcrops: A neglected, critical open habitat
- 2 Land-use change in rock outcrops: The people's perspective
- 3 Rocks, people and rock-dwelling fauna in the outcrops
- 4 Let's design a study
- 5 The rock-turning data: Activity based data exploration
- 6 Interpreting the data: How do animals respond to the land-use change
- 7 Thinking Towards Conservation Measures: Biodiversity Heritage Sites
- 8 Let's reflect: An Assessment

Role of 4DEE in the module development

- Confidence in considering the 4DEE axes as key learning objectives.
- Exploring 'hidden' dimensions such as stakeholder analysis, and conservation recommendation dilemma.

Learning objectives

- Describe the ecology and human-nature relationship in a tropical rock outcrop system.
- Quantify the rock availability and rock-dwelling animal prevalence across various land-use types
- Use rock-turning data to assess the impact of land-use change on the species occurrence.
- Integrate research results in creating conservation measures suggestions in a threatened habitat.



Thinking Towards Conservation Measures: Biodiversity Heritage Sites

The low-elevation lateritic plateaus are not protected, have received poor conservation attention, and are being rapidly converted to orchards. Proposed development projects such as **refineries** and power plants have also been planned. Additionally, plateau rocks are being used extensively for multiple human activities.

This shows that there is a need for systematic biodiversity inventories of the lateritic plateaus, identifying key plateaus, and working with local communities towards their conservation.

Habitat restoration in plateaus, where large rocks have been heavily depleted, can be explored through **the introduction of aptly designed artificial rocks**. The information collected in this study, in conjunction with other socio-ecological information collected as part of our larger research projects, will contribute to declaring select plateaus as **'Biodiversity Heritage Sites'** with the due consent of local communities.

LET'S THINK

Imagine you are being asked to suggest a few conservation measures for the plateaus, focusing on the endemic caecilian and gecko. Can you write a few suggestions?

How do we use these ecological knowledge in landscape restoration, and species conservation?

Next: Let's reflect: An Assessment ►



An oil refinery in Maharashtra is dividing villages in the Konkan belt

While a section of villagers support the proposed multibillion-dollar Ratnagiri Refinery and Petrochemicals Limited project discreetly, others oppose it

[thehindu.com](https://www.thehindu.com) >

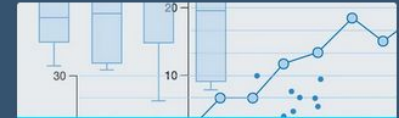
List of Biodiversity Heritage Sites of India - Wikipedia

Biodiversity Heritage Sites are notified areas of biodiversity importance in India.

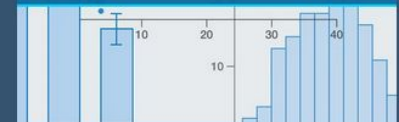
en.wikipedia.org >

“Where rocks or rock piles have been removed they may be rebuilt and restored, and sometimes artificial rocks are used.”

[conservationevidence.com](https://www.conservationevidence.com) >



Data Explorer



Data Explorer

This web tool provides a quick and easy way of visualizing and analyzing data without advanced technological requirements. With Data Explorer, students can easily create a variety of plots to visualize data. They can also quickly generate statistical summaries and perform hypothesis testing with a variety of tests.

How did the students react?

- Portions of the module has been used in BIOL 208 - Biodiversity class (Biology, Physician Assistant/ Health Sciences or Premedical Studies majors) at the Thomas Jefferson University, Pennsylvania.

“Because rock outcrops are found across the world, I researched our local areas in Pennsylvania area to determine if habitat destruction from the overturning of rocks is universally as well. **I found that a natural gas pipeline being built across the country is removing rocks in current and potential Timber Rattlesnake habitats.** Although they change routes for current dens, they do not avoid gestational habitats.”

“The scientists' work in the hotspot shed light on the fact that hidden areas under rocks are still so important to the biodiversity of a habitat. When observing a "barren wasteland" at first sight, it may look like the **land is useless and wasting money if it is not being used for something to benefit humans.** However, the researchers' work highlighted the hidden gems of the ecosystem by physically overturning over 7,000 rocks!”

Way forward

- Looking forward to more engagement with educators and students to modify the module/ tailor it according to the curriculum.
- See how the module can be used in Indian undergraduate classes.



Scan here to access
the
Online [Module](#)

Acknowledgements



Support was provided by: A grant from the United States National Science Foundation (DBI-RCN-UBE 2120141).

Thanks to: Ann E. Russell, Edward Waisanen, Suzane Macey, Anne H. Bower (OCELOTS Network), Aparna Watve (BEAG-India), Rohit Naniwadekar (NCF-India), Anaswar K.; Those who supported our team during the research work for this module.

