

THE SCHOOL FOR FIELD STUDIES

DIRECTED RESEARCH BHUTAN

Center for Climate and Sustainable Futures · Paro. A complete record of student research projects from the four most recent semesters.



SPRING 2026

6 projects · 26 student authors

FALL 2025

6 projects · 28 student authors

SPRING 2025

6 projects · 26 student authors

FALL 2024

7 projects · 28 student authors

25

RESEARCH PROJECTS

108

STUDENT AUTHORS

3

FACULTY ADVISORS

4

SEMESTERS

FALL 2024 – SPRING 2026

ABOUT THIS GUIDE

Directed Research is the capstone of every SFS semester: students work in small teams with resident faculty on questions set by the needs of the host community and its ecosystems. This guide collects the Directed Research projects completed at the Center for Climate and Sustainable Futures in Paro, Bhutan, over the four most recent semesters.

Projects are listed newest first. Each entry gives the project title, its faculty advisor or advisors, and the student authors with their home institutions. Each entry closes with a research summary drawn from the Center’s semester final report for that project. Where a project’s final paper carries a formal author abstract, that abstract replaces the summary and is labelled as such.

CONTENTS

SPRING 2026	6 projects · 26 student authors
FALL 2025	6 projects · 28 student authors
SPRING 2025	6 projects · 26 student authors
FALL 2024	7 projects · 28 student authors

FACULTY ADVISORS

Directed Research at the Center for Climate and Sustainable Futures was advised by 3 faculty and researchers across these semesters.

ADVISOR	PROJECTS	SEMESTERS
Dr. Kuenga Wangmo	10	All four semesters
Dr. Tshering Tempa	10	All four semesters
Dr. Norbu Wangdi	5	All four semesters

Center for Climate and Sustainable Futures · Paro, Bhutan

01 **Multi-Year Occupancy Dynamics of Small Felids Along an Elevational Gradient in the Bumdra-Ragey-Taktsang Region of Paro, Bhutan**

Faculty advisor: Dr. Tshering Tempa

Caroline Simmonds¹, Hanna Noyes², Leilani Fleming³, Mena Tanner⁴

¹ Bowdoin College, ² Colby College, ³ Swarthmore College, ⁴ Davidson College

RESEARCH SUMMARY

Small cats are among the least-studied carnivores of the eastern Himalaya. Drawing on the Center's camera-trap array, this project analysed multi-year occupancy dynamics of small felids across an elevational gradient in the Bumdra–Ragey–Taktsang region above Paro, asking how occupancy shifts with elevation and between years. Camera availability constrained coverage — of 32 traps, two were lost and two malfunctioned — and the array will be enlarged and extended toward the Dragay Pangtsho area on the recommendation of local foresters.

02 **Investigating the Impact of Livestock Herding on Spatiotemporal Predator-Prey Interactions of the Asiatic Wild Dog in the Paro Valley, Bhutan Region**

Faculty advisor: Dr. Tshering Tempa

Holly Bowden¹, Robin Linse², Clara Witmer³

¹ Denison University, ² Grinnell College, ³ Lafayette College

RESEARCH SUMMARY

Asiatic wild dogs share the forests of the Paro Valley with herded livestock, and this project investigated how that herding alters the spatial and temporal overlap between the wild dogs and their prey. Camera-trap records were used to compare where and when predator, wild prey, and livestock occur across the valley. As with the small felid survey run from the same array, camera losses limited coverage; the array will be expanded toward Dragay Pangtsho at the local foresters' recommendation.

03 **Avian Community Composition Across a Himalayan Elevational Gradient at Chele La Pass, Paro, Bhutan**

Faculty advisor: Dr. Tshering Tempa

Jaden Salett¹, Eliana Heiser¹, Penny Yost², Oscar Hagen³, Levi Gewirz⁴

¹ Cornell University, ² Wellesley College, ³ University of Minnesota–Twin Cities, ⁴ Bates College

RESEARCH SUMMARY

Chele La Pass climbs a steep Himalayan elevational gradient, and this project described how avian community composition changes along it. It was the Center's first use of mist netting for bird community work: more than twelve transect lines were cut with the help of two full-time field assistants, making it a labour-intensive undertaking. Continuing the study will require the Center to acquire its own mist nets and associated equipment, and GPS tags are under consideration for following migration.

04 When Seasons Don't Speak Clearly: Climate Change Impacts in Haa Dzongkhag

Faculty advisor: Dr. Kuenga Wangmo

Mariposa Condrón¹, Valentina Mendoza Cruz², Maya Rosner³, Mariel Shuler⁴

¹ Grinnell College, ² Denison University, ³ University of Vermont, ⁴ Scripps College

RESEARCH SUMMARY

Farmers in Haa Dzongkhag read the seasons to decide when to plant, graze, and harvest, and those signals no longer arrive as they did. Part of the Center's "Stories of Change in Landscapes and Lives" series, this project recorded how communities in Haa experience and describe climate change and its effects on their livelihoods. Interviews were conducted with trained enumerators acting as translators, which the advisor credits with improving both the research process and the quality of the data. One student intends to continue the work with the advisor.

05 Food System Livelihoods in Haa Valley

Faculty advisor: Dr. Kuenga Wangmo

Liam Boyles¹, Inês Reis², Molly Strohmeyer³, Margot Wilder⁴, Greta Yauch⁵

¹ University of Vermont, ² Bates College, ³ University of Wisconsin–Madison, ⁴ Hamilton College, ⁵ Tufts University

RESEARCH SUMMARY

Also part of "Stories of Change in Landscapes and Lives," this project examined the livelihoods that Haa Valley's food system supports — how households produce, trade, and depend on food in a district on the edge of rapid change. Haa is expected to shift within a few years from a quiet dzongkhag to a tourism destination, which makes a record of current food livelihoods valuable as a baseline. The advisor notes that the students collected data the Center hopes can be used beyond this project.

06 Assessing the Survival Rate of Bhutan's Million Trees Initiative Plantations: Environmental and Management Drivers of Success

Faculty advisor: Dr. Norbu Wangdi

Audrey Luben¹, Gracie Mabey², Abby Blandford³, John Tuite³, Aidan Tartarelli⁴

¹ Elon University, ² Grinnell College, ³ University of Minnesota, ⁴ Williams College

RESEARCH SUMMARY

Bhutan's Million Trees Initiative began planting in 2021, but the survival of those plantations had not been measured. This project assessed plantation survival rates in Tsirang, Dagana, and Wangdue districts and identified the environmental and management factors separating successful sites from failed ones. The results gave the Bhutan Ecological Society a baseline for the initiative's success, and the advisor intends to repeat the study in Chukha and Samtse.

01 Multi-Season Occupancy Analysis of Asiatic Wild Dogs in Paro Valley, Bhutan**Faculty advisor:** Dr. Tshering TempaEmmie Corbin¹, Mara Glinberg¹, Will Nakahara², Scout Noble³, Bryce Papp¹, Iris Petrin⁴¹ University of Wisconsin/Madison, ² Colorado College, ³ Wesleyan University, ⁴ Bates College**RESEARCH SUMMARY**

This project analysed multi-season camera-trap data on Asiatic wild dogs in the Paro Valley, testing how occupancy changes across seasons rather than at a single point in time. The advisor describes the preliminary findings as promising, but the survey was set back by camera-trap loss and tampering that left planned survey areas uncovered. Recovering the design depends on procuring a further ten to fifteen traps and deploying improved locks, camouflage, and official signage to deter interference.

02 Predator-Prey Dynamics: Co-Occurrence of Dhole with Livestock and Wild Prey in the Bumdra-Taksthang Area, Paro Valley**Faculty advisor:** Dr. Tshering TempaJack Schwarting¹, Ellarain Moore², Michelle Laferriere³, Broden Walsh⁴, Sean Mulhall⁵, James Owen⁶¹ Middlebury College, ² Reed College, ³ Colorado College, ⁴ Tufts University, ⁵ Rochester Institute of Technology, ⁶ University of Vermont**RESEARCH SUMMARY**

Dhole in the Bumdra-Taksang area encounter both wild prey and herded livestock, and this project measured the co-occurrence of the three at camera-trap stations across the Paro Valley. Comparing where dhole overlap with livestock against where they overlap with wild prey speaks directly to the conditions under which livestock predation occurs. The project shares the array — and the equipment constraints — of the multi-season occupancy study run alongside it.

03 A Comparative Study on Community-Based Tourism and Conventional Tourism in Punakha, Bhutan**Faculty advisor:** Dr. Kuenga WangmoHazel Stanfield¹, Sophia M. Spindler-Krage², Emma DeFilippes¹, Olivia Chang³¹ Scripps College, ² Grinnell College, ³ Olin College of Engineering**RESEARCH SUMMARY**

Bhutan promotes community-based tourism as a model that keeps more value in host communities, and this project compared it against conventional tourism in Punakha. Hotels and homestays across the dzongkhag were surveyed to set the two models side by side. The study produced recommendations to be shared with the Department of Tourism; the advisor notes that Punakha's small number of establishments would have allowed a full census rather than a sample had logistics permitted.

04 Setting Down the Plough: Agricultural Futures of Tourism in Bhutan**Faculty advisor:** Dr. Kuenga Wangmo

Elleanora da Silva¹, Forrest Feist², Grace Knuth³, Helena King⁴, Phebe O'Connor⁵

¹ Skidmore College, ² Reed College, ³ Wellesley College, ⁴ Dickinson College, ⁵ Colorado College

RESEARCH SUMMARY

As tourism grows in Bhutan, farming households weigh whether to stay on the land, and this project examined what that pressure is doing to agricultural futures. Interviews across the study sites traced how households are shifting between farming and tourism work. The advisor notes the findings would be strengthened by a more tightly defined target group and a larger set of informants; fieldwork was constrained by a single vehicle shared among three project groups.

05 Perceptions of Tourism's Impacts on Bhutanese Cultural and Religious Heritage

Faculty advisor: Dr. Kuenga Wangmo

Ava Romano¹, Sophia Swanson², Cecily Trowbridge²

¹ Scripps College, ² Reed College

RESEARCH SUMMARY

This project recorded how Bhutanese people perceive tourism's effects on their cultural and religious heritage, including the monastic communities whose sites visitors come to see. The result ran against the project's hypothesis: monastics expressed overwhelmingly positive sentiment toward tourists. The advisor considers the finding worth pursuing and hopes to extend the study to other regions of Bhutan to see whether it holds.

06 Bridging the Gaps: Integrating Policy, Science, and Tradition in Bhutan's Water Governance

Faculty advisor: Dr. Norbu Wangdi

Naisha Gaur¹, Ezra Krantz², Corinne LePage³, Maya Surbeck²

¹ Dickinson College, ² Reed College, ³ Brown University

RESEARCH SUMMARY

Water governance in Bhutan sits across policy, hydrological science, and customary practice, and this project examined how the three fit together — or fail to. Fieldwork in Thimphu, Paro, and Punakha surfaced coordination and capacity problems that persist even under the transformed arrangements of the civil service reforms. The advisor intends to extend the work to gewogs in central, southern, and eastern Bhutan and to publish a review of water governance following the reforms.

Center for Climate and Sustainable Futures · Paro, Bhutan

01 **Harvesting Heritage: Evaluating Agritourism Potential in Bhutan as a Path to Sustainable Development and Cultural Preservation**

Faculty advisor: Dr. Kuenga Wangmo

Hannah Gilmer¹, Isabel Duane², Jess Li³, Colleen Maloney⁴

¹ Middlebury College, ² Trinity College, ³ Brandeis University, ⁴ Macalester College

RESEARCH SUMMARY

Agritourism is an emerging proposition in Bhutan, and this project evaluated its potential as a route to sustainable development that also sustains cultural practice. Stakeholders across the sector were interviewed to establish where the opportunity lies and what conditions it requires. The advisor recommends a larger sample and interview questions standardised across stakeholder groups in future work, so that comparisons hold and the evidence can support planning.

02 **Harvesting Heritage: The Social and Economic Viability of Agritourism in the Haa Valley**

Faculty advisor: Dr. Kuenga Wangmo

Maya Basnyat¹, Mia DiLorenzo², Callie Goodman³, Emma Fellows⁴

¹ University of Richmond, ² Harvard University, ³ University of Wisconsin/Madison, ⁴ Wheaton College

RESEARCH SUMMARY

The companion study to the agritourism potential assessment, this project tested the social and economic viability of agritourism specifically in the Haa Valley. It found that siting agritourism where a place is culturally rich and already carries other tourism products — nature-based tourism among them — may prove more effective than selecting sites on agricultural output alone. The findings are being shared with the Director of the Department of Tourism, who took part in the study, as the department explores agritourism in districts such as Tsirang and Dagana.

03 **Seasonal Habitat Use of Sambar Deer in the Taktsang-Bumdra Region**

Faculty advisor: Dr. Tshering Tempa

Annika Burman¹, Madeline George², Avi Kahn³, Avery Leigh⁴, Theo Ollier⁵

¹ University of Michigan, ² Gonzaga University, ³ Williams College, ⁴ Knox College, ⁵ Colorado College

RESEARCH SUMMARY

Sambar deer are a principal prey species for the Paro Valley's large carnivores, and this project described their seasonal habitat use in the Taktsang-Bumdra region from camera-trap records. With two years of data now in hand, the array supports comparison across seasons and years rather than a single snapshot. Camera trapping continues, and the advisor intends to expand to roughly fifty stations if funding allows, making it a rare multi-year wildlife monitoring dataset for Bhutan.

04 **Predator-Prey Relations Between *Martes flavigula* and Pheasants in the Taktsang-Bumdra Region of Bhutan**

Faculty advisor: Dr. Tshering Tempa

Ori Arvidson¹, Caleb Boxwell², Maddie Hoskin³, Kieran Timmins⁴

¹ University of Wisconsin, ² Colby College, ³ Purdue University, ⁴ University of Minnesota

RESEARCH SUMMARY

This project examined predator–prey relations between the yellow-throated marten (*Martes flavigula*) and pheasants in the Taktsang–Bumdra region, using the Center’s camera-trap array to compare where and when the two occur. Both are common in the record, but their interaction is undescribed for Bhutan. Camera trapping continues and would expand to about fifty stations with additional funding.

05 Species Distribution and Niche Partitioning of Meso-Predators in Paro Valley, Bhutan

Faculty advisor: Dr. Tshering Tempa

Grace Lerner¹, Julia Ng-Heth², Barton Ritchay², Maya Whitcomb³

¹ Montana State University, ² University of Vermont, ³ Middlebury College

RESEARCH SUMMARY

The Paro Valley supports a set of mid-sized carnivores sharing the same forests, and this project mapped their distribution and asked how they partition that space. Camera-trap detections were compared across species to identify separation by habitat, elevation, and time of day. The array now holds two years of data and will keep running, with expansion to roughly fifty stations planned if funding is secured.

06 Hybrid Water Systems for Bhutan Urban Resilience: The Role of Groundwater in Paro and Phuentsholing Thromdes

Faculty advisor: Dr. Norbu Wangdi

Scott Carter¹, Eliana Cohen², Bryce Maloney¹, Izzy Simon³, Siena Yannotti⁴

¹ Holy Cross, ² Grinnell College, ³ Bard College, ⁴ Skidmore College

RESEARCH SUMMARY

Groundwater is a largely unexplored research topic in Bhutan, yet towns such as Phuentsholing have depended on it for most of their water since the 1990s. This project assessed the role of groundwater in the hybrid water systems serving Paro and Phuentsholing Thromdes and what it means for urban resilience. Detailed feasibility assessments for existing boreholes proved hard to obtain. The study recommends urgent groundwater resource mapping in major urban areas, monitoring of existing boreholes, and stronger record keeping and institutional memory in municipalities.

01 Effects of varied human disturbance levels on wildlife occupancy in Paro, Bhutan**Faculty advisor:** Dr. Tshering TempaNell Bernard¹, Sofia Brown², Jeremy Jarecki³, Lily Waldman⁴, Biana Qiu⁵¹ Middlebury College, ² University of California Los Angeles, ³ Colorado College, ⁴ Scripps College, ⁵ Denison University**RESEARCH SUMMARY**

Human activity in Paro's forests ranges from heavily used trails to little-visited slopes, and this project tested how wildlife occupancy responds across that range of disturbance. Camera-trap detections were analysed to estimate occupancy for the species recorded at each level of human use. Trap numbers limited the design, though the advisor reports the occupancy analysis worked well; multi-session co-occupancy analysis is planned from the ongoing array.

02 Understanding Human-Wild Pig Conflict in Paro Valley, Bhutan**Faculty advisor:** Dr. Tshering TempaKatarina Andersen¹, Emilio Guerrero², Nolan Tracy³¹ Davidson College, ² Austin College, ³ Brandeis University**RESEARCH SUMMARY**

Wild pigs raid crops across the Paro Valley, and this project investigated the conflict from both sides — where the pigs occur, and how farming households experience the damage. Camera traps covered a limited set of habitats, which the advisor notes did not represent the full range of habitat wild pigs use. More traps will be deployed across a wider spread of habitats and disturbance levels in later semesters.

03 Assessing Plantation Survival Rates for the Million+ Trees Initiative: A Pilot Study in Bhutan**Faculty advisor:** Dr. Norbu WangdiIsabel Braun¹, Katelyn Clark², Ella Dittmer³, Mary-Sophia Shakespeare⁴¹ Kenyon College, ² University of Vermont, ³ Davidson College, ⁴ Reed College**RESEARCH SUMMARY**

This pilot study assessed plantation survival for Bhutan's Million+ Trees Initiative, surveying planting sites and the households responsible for them across four districts of western Bhutan. Twenty-five households were surveyed — too few for a comprehensive account — and because the saplings measured were under five years old, the survival figures may overstate long-term outcomes. The advisor intends to extend the survey to households in further districts.

04 Planted Potential: Assessing the Socio-Ecological Impacts of the Million+ Trees Reforestation Project**Faculty advisor:** Dr. Norbu WangdiAaron Gilbert¹, Sajni Sheth-Voss², Tanner Lee³¹ University of Michigan, ² Scripps College, ³ Davidson College

RESEARCH SUMMARY

The companion study to the plantation survival pilot, this project assessed the socio-ecological impacts of the Million+ Trees reforestation programme, interviewing officials from the Bhutan Ecological Society, the Forest Department, and local forest offices alongside households in Paro, Thimphu, Punakha, and Wangdue. Sites were chosen for logistical feasibility, which narrowed the range of management styles the study could compare. Many households reported receiving fruit trees rather than timber species, so the advisor notes that agriculture and horticulture officials should be included in future work.

05 **From Ritual to Responsibility: How Location of Residence, Age, and Type of Education Influence the Perception of the Environmental Impact of Prayer Flags in Bhutan**

Faculty advisor: Dr. Kuenga Wangmo

Ellis Branca¹, Lauren Elsea², Andrea Ray³, Abigail Riseman⁴, Carla Schmidt⁵

¹ Northern Arizona University, ² Colorado College, ³ University of Minnesota Twin Cities, ⁴ Clark University, ⁵ Trinity College

RESEARCH SUMMARY

Prayer flags are raised across Bhutan's landscape as a matter of religious practice, and their material afterlife carries an environmental cost. This project measured how location of residence, age, and type of education shape people's perception of that impact. Data collection overlapped a week-long local religious event, which made some demographic groups hard to reach and left smaller samples than planned. The advisor intends to keep gathering perceptions and analysing the factors behind them.

06 **Living on a Prayer (Flag): A Preliminary Biophysical Survey into the Environmental Impacts of Prayer Flags**

Faculty advisor: Dr. Kuenga Wangmo

Aryan Ashraf¹, Elle DesMarteau², Clara Morgan³, Emma Schlutt⁴

¹ Swarthmore College, ² Scripps College, ³ Skidmore College, ⁴ Salisbury University

RESEARCH SUMMARY

The first entirely biophysical research project run at the Center, this preliminary survey measured the impacts of prayer flags on soil and water, carried out with the National Soil Services and the College of Natural Resources. It was undertaken because the Department of Forestry Services, a potential user of the research, lacked quantifiable data on those impacts. Laboratory facilities and funding limited the testing and sample size, and the study identified critical equipment gaps — including the absence of a microscope capable of detecting microplastics. The advisor regards the most useful outcome as a more rigorous methodology for future studies of the same question.

07 **Sustainable Alternatives to Prayer Flags in Bhutan: The Middle Path Between Spiritual Tradition and Pro-Environmental Innovation**

Faculty advisor: Dr. Kuenga Wangmo

Samir Ashford¹, Alex Catterson², Yuqi Cui³, Sargam Nohria⁴

¹ Reed College, ² University of Colorado Boulder, ³ Hamilton College, ⁴ University of Massachusetts

RESEARCH SUMMARY

If prayer flags carry an environmental cost, the question becomes what might replace them without displacing the practice. This project looked for a middle path between spiritual tradition and pro-environmental innovation, identifying which alternatives are likely to succeed and who would drive their adoption. The work had many components and was

logistically demanding, but the advisor describes the findings as highly insightful and the resulting recommendations as practical and actionable.

THE SCHOOL FOR FIELD STUDIES

Center for Climate and Sustainable Futures, Paro, Bhutan. Titles, faculty advisors, student authors, and home institutions compiled from the SFS Directed Research project lists for Fall 2024, Spring 2025, Fall 2025, and Spring 2026.