

Sustainability and Environmental Justice

The Keough School strives to address the contested relationship between poverty, climate change and environmental degradation, including the increasing loss of biodiversity and the ravaging of forests and the soil upon which farmers depend. At Notre Dame, as **Daniel Miller** noted in introducing the first panel of this section of the conference, we emphasize Catholic social teaching, which embraces a “preferential option for the poor”—and yet, it is the poor who are most affected by environmental change. What does “sustainability” mean in this context, and how might sustainable and just practices and policies be identified and implemented?

In her paper and presentation on “Sustainability and Environmental Justice in the Energy Transition,”¹ **Emily Grubert** first reviewed the cause of climate change and the extreme threat it poses to human thriving. We have understood the basic mechanism of the greenhouse gas effect for well over a century, and international policy attention has focused on climate change for over 30 years, she noted. Many have already experienced loss of life, loss of homes, loss of loved ones, loss of culture, and many other consequences of climate change.

Greenhouse gas emissions into the atmosphere – the driver of continued and accelerating climate change – continue to grow, with record emissions in 2023. The large majority of these anthropogenic greenhouse gas emissions (GHGs) are the result of burning fossil fuels for energy – accounting for roughly 80 percent of gross global emissions, in the form of carbon dioxide (CO₂) and methane (CH₄). “These emissions drive devastating global change, with massive international and intergenerational injustices driven by the spatial and temporal mismatches between emissions and effects of climate change,” Grubert said. International agreements have focused on attempting to limit the impact of climate change to the damages to the natural environment that we experience when global warming stays below 2° Celsius of preindustrial averages, and preferably below 1.5° Celsius. Yet January 2024 marked the end of the first consecutive 12-month period where global temperatures exceeded 1.5° Celsius, though breaching this threshold permanently is not yet locked in.² People, other species, and ecosystems are already feeling the disastrous effects of this level of warming, she added, including through devastating and costly storms, heat waves, floods, droughts, and human displacement.

As has been true for decades, about 80 percent of the global energy system relies directly on fossil fuels – oil, coal, and natural gas.³ Energy consumption, which is positively correlated with standard of living, remains highly unequal globally: 675 million people have no access to modern energy systems, and many more have very limited and/or inconsistent access.⁴ Energy access and extreme poverty are problems not only in Low and Medium Income (LMI) countries, but also in High Income countries, where many do not benefit from their

countries' high incomes. In the US, about one-fifth of adults were unable to fully pay an energy bill in the last 12 months⁵ —an energy insecurity phenomenon sometimes described as the “heat or eat” dilemma.⁶ In short, Professor Grubert said,

Energy access – and particularly the ability to secure and use sufficient nonpolluting, ecologically manageable, and socially acceptable energy to enable both surviving and thriving – is a major international justice issue. Beyond climate change, energy systems – and especially fossil fuel-based energy systems – are major drivers of localized pollution with significant and sometimes severe impacts on human and ecosystem health. This, too, is a major justice problem: not only are such harms in general undesirable, but they are also highly unevenly distributed, often creating and reinforcing generational patterns of overburden and vulnerability.⁷

Institutionally, fossil fuel companies are implicated in significant and troubling patterns of injustice, Grubert contended. Significant evidence, she noted, now supports claims that major oil and natural gas producers have long been aware of the climate implications of burning fossil fuels and have taken steps to delay or halt global response.⁸ Coal producers are internationally known for their antagonistic roles in labor history. In the United States, which allows for private rather than public ownership of mineral resources like fossil fuels, companies have abandoned pension and environmental obligations through bankruptcy, leaving communities impoverished and ravaged.⁹ Noncompliance with pollution controls is common, as are patterns of extraction that contribute to the “resource curse,” wherein countries whose fossil fuel resources are extracted do not see expected development benefits; instead, the wealth is exported and concentrated beyond producer countries.

In considering questions of international justice, which is a mandate of the Keough School, there are “major opportunities” to improve energy systems, Grubert noted, and to envision and implement policies and practices that will serve current and future generations. Transitioning away from fossil fuels, while technically challenging, is clearly possible, she affirmed, owing to rapid technological progress enabling the development of alternatives to fossil fuel systems. But this challenge is inextricably linked to questions of social justice; technological progress, Grubert insists, is not enough. Institutions must also ensure justice and correct historical injustices in apportioning resources as well as burdens.

One of the core challenges of transition, she explained, is that new clean energy systems need to operate together with and alongside existing, older fossil infrastructures.¹⁰ Moreover, the new systems “enter into market and other contexts that we know are insufficient for achieving ambitious goals.” Utility rate structures that force people even in wealthy countries into “heat or eat” dilemmas do not change simply because the electricity is now made from wind rather than natural gas, for example, and installing solar panels does not remediate the long-term health effects from the refinery that operates nearby. The urge to seek out one-to-one replacements, like personal electric cars in place of internal combustion engine cars or solar jobs in place

of coal jobs in the same town, can mask opportunities to identify and implement something better. System redesign that integrates new structures and older structures, including those being phased out, is complicated by the fact of different starting parameters, challenges, and constraints around the world. The “mid-transition” period could last decades, even at top speed.¹¹

In the energy transition— which occurs with the backdrop of decades of disinvestment and deferred maintenance, significant technological change, and accelerating climate change— it is possible that the beginning point (a mostly fossil fuel-based system) and the end point (a non-fossil-fuel-based system) are both significantly more stable and easier to operate than the dynamic hybrid systems we will rely on in the middle. Again, Grubert emphasized, this is a call to accelerate, rather than decelerate, the transition.¹²

Current research on the energy transition, Grubert explained, tends to focus on what we need to build: renewable electricity generation, the ability to use electricity to provide services that currently rely on direct use of fossil fuels (e.g., heating and transportation), decarbonized fuels for industrial and commercial applications that cannot electrify, and more controversially, potential geoengineering capabilities focused on removing carbon dioxide from the atmosphere (carbon dioxide removal, CDR) or on reducing the heat that reaches the Earth (solar radiation management, SRM). However, there is far less research that identifies explicit and specific strategies for phasing out fossil fuels in a way that is safe, allows for continuity of services, and avoids saddling already-burdened host communities with additional environmental, social, and financial liabilities associated with abandoned and un-remediated infrastructure. Although fossil phase-out must be done as quickly as possible, it must also be done safely, which likely requires both significant planning and ongoing access to the expertise of workers who are increasingly aware that their industries have limited futures. For critical services like heat, phase-out cannot be completed until a new, reliable way of delivering services is in place and trustworthy.

In the overall context of the global energy transition, the US presents a particularly important target of research and execution. Not only is the US a long-term industrialized country with aging fossil infrastructure that is ripe for replacement¹³ and substantial wealth available to fund transition, but it is also a critical participant in the global context. The world’s largest cumulative emitter of fossil fuels, at about 25 percent of all anthropogenic greenhouse gases emitted to date, the US is also a notable laggard or, often, non-participant in global action on climate change. In a globalized energy economy, the US is also the world’s largest producer of oil, the largest producer of natural gas, and the fourth-largest producer of coal. (For many years the US was the largest producer of coal, before standing by as the industry collapsed in a haphazard and unregulated manner— a cautionary tale of an unjust transition.)

Institutionally, the US is extremely unusual, Grubert added, in that fossil fuel resources are often privately held, as are critical energy service providers like refineries and many utilities. The country has no legally binding climate targets, and policies have so far focused primarily on subsidies without explicit plans for how transition might (or might not) occur. The US remains a major international proponent of natural gas use, expecting to be a provider to international markets even as global understanding of climate change reinforces the need to reach net-zero emissions by mid-century in order to improve chances of remaining below negotiated temperature thresholds. It is also a global leader in the development of hydrogen and carbon dioxide removal technologies, both of which could be critically important for meeting international climate goals but could also create major and long-lasting injustices and harms if poorly implemented. However, she added, US policy, which is influencing other countries seeking to develop these potentially major industrial sectors, is so far allowing for significant capture by oil and natural gas interests. “For all these reasons the United States is a particularly important target for identifying and then demonstrating how a just energy transition can occur.”

In the US context, where there is no explicit federal energy policy and no real authority for domestic energy system planning, one major transition question stands out: how can this undertaking be orchestrated in a way that efficiently and effectively delivers a successful transition to a more just, less polluting, and climate-preserving energy future? Some centralized coordination is almost certainly required, given the normative and directional nature of the transition. Market forces have proven to be insufficient: one estimate suggests that for all but one of the US’ coal-fired power plants, it would be cheaper to replace the plant with brand new clean energy systems than to continue to operate the plant – and yet, coal continues to supply about 20 percent of US electricity, in part because of regulatory structures in the utility sector, and in part because of the fundamental reality that decisions are driven by profitability rather than cost.¹⁴ Implementing a carbon tax, often held out by economists as the most efficient way to decarbonize, is unlikely to deliver a transition, Grubert added. Aside from the enormous administrative challenges (including those associated with appropriate greenhouse gas accounting), there are many situations where emitters would likely choose to pay even a very large tax rather than stop emitting.¹⁵

Overall, Grubert concluded, a justice-centering energy transition needs to be coordinated, with careful attention to which systems are available to provide which services. This need points to a deeper design principle, which is that a true justice focus for the energy transition also requires a focus on service provision:

The goal of energy systems is not to ensure that electricity reliability exceeds 99.999 percent (a common design standard), or to guarantee specific transportation fuel throughout: it is to ensure that people have access to heat, light, mobility, and other services. It is service reliability rather than energy supply reliability that should therefore be the focus, a reality that also implicates questions of how all people

can access other critical needs – like housing, healthcare, and many others – as fundamental to the energy transition. Service-first design allows for more visioning about what the world would need to, and could, look like if people’s needs were met and allows for creative recognition of alternative strategies. For example, efficient housing might be able to serve heating and cooling service needs as well as additional electricity generation; density and public transportation might be able to serve mobility needs as well as affordable electric vehicles. In general, a reorientation of energy transition research toward services and away from supply-first strategies can support justice goals, context-aware implementation of effective strategies, and a true focus on what we want out of an energy system. Moving away from a paradigm where energy is a group of commodities that can deliver profits and instead is a crucial enabler of human thriving, is core to the potential for a truly just energy transition.

In his paper **Paul Winters** recommended a similar focus on consumers and justice in his argument for transformation in the agriculture and food sectors. Proposals to transform food systems to address climate change and nutrition often ignore vulnerable populations and could worsen their plight.¹⁶ Even country-level proposals included in Nationally Determined Contributions documents under the Paris Agreement on climate change would increase global poverty by an estimated 4.5 percent if implemented as described.¹⁷

Innovations will be central to transforming food systems and will need to be taken to scale. Unfortunately, the global institutional architecture “is not well set up to develop and scale innovations at the level needed.” Even though half the world’s population now lives in urban centers, the majority of people living in extreme poverty and food insecurity are in rural areas, Winters explained. They directly or indirectly rely on agriculture for their livelihoods. Accordingly, rising productivity growth in the agriculture sector has been seen as central to success.¹⁸ Yet growth in the agricultural sector does not guarantee poverty reduction or ensure food security. Proactive policies and investments are necessary to ensure the inclusion of rural households living below the poverty line, women, indigenous people, youth, and other vulnerable groups in the development process.¹⁹

With this in mind, development efforts over recent decades have focused on inclusive rural development in the midst of continued and growing issues with climate change and malnutrition. Estimates suggest that climate change could push more than 100 million additional people into extreme poverty by 2030, with half of this increase due to the impact of climate change on agriculture.²⁰ Under high-emissions scenarios, climate change will make some current areas unsuitable for food production due to hazards that impose hard limits on any type of production.²¹ These challenges are particularly problematic in lower-income countries where agriculture contributes an important share of GDP and is a significant employer, and where the capacity to respond to hazards is limited.

Complicating matters, Winters writes, the gains in agricultural productivity and production have come at an environmental cost, including increased GHGs. Many modern production practices (such as soil management, synthetic fertilizers, and the expansion of agricultural land use) increase emissions. The overall food system—from production to consumption—contributes 25-35 percent of total greenhouse gas emissions, making the sector second only to energy in terms of total emissions.²² A number of factors contribute to this, including the loss and waste of 33 percent of food globally²³ and agriculture-based deforestation. Although low- and middle-income countries are not considered primarily responsible for GHG emissions, he added, there is a concern that if they follow a similar agricultural path as other countries, this could lead to an agricultural and food system that is high in emissions and result in future problems.

Along with climate change challenges, the manner in which food systems operate creates nutritional challenges. The historic focus on staple-crop productivity (rice, maize, wheat, potatoes, etc.), the manner in which food is processed, and changing lifestyles have led to a nutritional transition in low- and middle-income countries that has resulted in a need to simultaneously address different forms of malnutrition (undernutrition, micronutrient deficiency, overweight/obesity, etc.). A quarter of global deaths are caused by dietary risk factors and low levels of physical activity).²⁴ Rural people are not immune from dietary issues. With rising urbanization in lower-income countries, 64 percent of the population lives within the catchment areas of towns and cities.²⁵ This greater access to urban food markets has caused the increase in obesity in low- and middle-income countries to be the greatest in rural areas.²⁶

With these issues in mind, there have been calls for creating new strategies, policies, and investments for transforming food systems to make them more climate friendly, nutritious, and inclusive of people living in poverty.²⁷ A key element of these calls is to take a broader food-systems approach that considers the synergies between biophysical and human systems. Incorporating food consumption patterns into new approaches is critical. Consumer behavior is closely linked to nutrition, but also determines production, processing, and food delivery, and thus leads to climate and environmental impacts.

While recognizing the need for broad food systems transformation, a focus on food security and poverty objectives must remain central to any discussions, Winters advised. Proposals to transform food systems to address climate change and nutrition often ignore vulnerable populations and could worsen their plight.²⁸ Even country-level proposals included in Nationally Determined Contributions documents under the Paris Agreement on climate change would increase global poverty by an estimated 4.5 percent if implemented as described.²⁹ There are significant potential trade-offs, as well as synergies, between achieving inclusion objectives and other objectives of food system transformation; the question is how to transform food systems in low- and middle-income countries to simultaneously address climate change, improve nutrition, and ensure inclusion. Put simply,

the manner in which productivity growth is achieved needs to change. It is essential that the scarce resources used for agricultural production and food systems, especially land and labor, are used wisely. Reductions in greenhouse gases are unlikely unless current resources are used as efficiently as possible.

The emphasis on productivity growth should shift from a strong focus on staple crops to a broader focus on diverse and nutritious diets. In doing so in low and middle-income countries, specific actions must be taken to ensure inclusion, since inclusion will not happen automatically.

As mentioned, innovation is central to food system transformation. At present, agriculture provides enough food for the world's 8 billion people, although many do not have adequate access. To feed the world in 2050, croplands would need to expand from between 171 million to 301 million additional hectares (relative to 2010).³⁰ Eliminating harmful practices such as deforestation and the use of synthetic fertilizer without alternative solutions would lead to a decrease in the world's food supply and in farmers' incomes.

To address the dilemma of ensuring sufficient production while minimizing GHGs, innovations must be developed and taken to scale so they reach hundreds of millions of people. Fortunately, Winters noted, numerous biological, technological, and social innovations have already been developed, and additional innovations are in the pipeline. For example, enhancing weather forecasts would have huge benefits for farmers, who are increasingly vulnerable to weather uncertainty due to climate change and need short- (0-3 days), medium- (4-10 days), and long-range (beyond 10 days) forecasts. Multiple studies find that farmers adjust their behavior and investment decisions in response to accurate weather forecasts. New technology and delivery systems allow more accurate, timely, high-quality, local forecasts, but most farmers in low- and middle-income countries currently lack access. As an illustration, the benefits of providing all state-level forecasts of the monsoon seasonal rainfall totals in India would exceed \$3 billion over five years.³¹

Commercial incentives to develop and scale these innovations, particularly in low- and middle-income countries, fall far short of their social value, leading to underinvestment. Innovation funding's track record of generating very high social rates of return creates an opportunity for public and philanthropic investment in innovation.

Of course, Winters cautioned, innovations are not silver bullets given to countries to solve their problems. Any potential innovation must be identified, developed, and scaled in a manner consistent with—and driven by—national strategies, in conjunction with the government, the private sector, and civil society. Promising local innovations should be considered for further development and scale via analysis to determine their impact, costeffectiveness, and potential for scaling. Any action on innovations must be based on existing evidence of what works.

From evidence to action for food system transformation

Food and agriculture took center stage at the UN Climate Change Conference in Dubai (COP28) in December 2023, where Winters played a behind-the-scenes intellectual leadership role. The *COP28 UAE Declaration on Sustainable Agriculture, Resilient Food Systems and Climate Action* commits signatory countries to make food systems a focal point in national strategies to address climate change—a necessary localization of effort, given the context-specific nature of appropriate agricultural practices, land use changes, and consumer behavior.

Supporting the development of agricultural innovations and providing large-scale funding to transition innovations to scale will be vital, Winters said. However, the global institutions currently in the food and agriculture space are ill-equipped to take on this role, he acknowledged. None of them meet the criteria for being a fund that can meet the objectives of scaling innovations, such as having a clear thematic or issue focus with distinct, numerable objectives; being results-oriented; having a degree of autonomy from their institutional home; and including public-private partnerships in the governance of the fund and/or in the implementation of services.³² There is precedent for the kind of necessary transformation that is required, however:

Just over 20 years ago, global leaders expressed frustration that vaccines, HIV/AIDS drugs, tuberculosis treatments, and malaria responses were not reaching hundreds of millions of people who needed them the most. The world responded with the creation of Gavi, The Vaccine Alliance, and the Global Fund to Fight AIDS, Tuberculosis and Malaria — along with billions of dollars to take innovations in these areas to scale. Gavi alone has helped to immunize over 1 billion children and prevented more than 17 million deaths helping to halve child mortality in 78 lower-income countries. Today, the world may need a “Gavi” to scale agricultural innovations to address climate change, improve nutrition, and ensure inclusion of people living in poverty and food insecurity.

Krister Andersson built on Winters’s presentation by discussing ways to promote more inclusive governance of rural landscapes. People living in rural areas in the Global South often lack access to clean water, healthcare, and other public services, he noted, making them extremely susceptible to suffer from environmental injustice, that is, a disproportionate exposure to pollution and environmental hazards such as heat, drought, and floods. To address environmental injustice, environmental activists and scholars often call for public policy interventions that can help reduce people’s exposure to hazards and improve poor people’s socioeconomic conditions so that they become less vulnerable.

To achieve such improvements through public policies has turned out to be quite difficult, sometimes even counterproductive, Andersson said, when policies aiming to reduce

vulnerabilities end up causing increased marginalization and widening inequalities. For example, governmental recovery programs that seek to help areas affected by hurricanes or cyclones often target property owners and offer little or no help to renters or landless people who are often much more vulnerable and in need of assistance, thereby contributing to the *increased* marginalization of the non-owners of property.³³ “Existing policies often fail to help more vulnerable members of our societies because those policies were created and designed by a decision process that excluded the voices and concerns from marginalized groups,” Andersson writes. “More inclusive governance is needed to address environmental injustice more effectively.”

Environmental injustice, he argued, is a symptom of systematic governance failure. It is not surprising, then, that when economic and political elites dominate the policymaking process, policy interventions tend to benefit mostly the elites. The tragedy is that such benefits can come at the expense of more marginalized members of societies. To address such inequities, researchers can make at least two important contributions: (1) Conduct research to uncover environmental injustices and socioeconomic inequalities, and (2) Engage stakeholders in research about inclusive governance.

Research to uncover environmental injustice and socioeconomic inequality

One of the paradoxes in efforts to promote sustainability, is that well-intentioned policy interventions to promote greater sustainability sometimes contribute to greater socioeconomic and environmental injustices. One example of such paradoxical outcomes comes from the research by Andersson and his colleagues about public policies that support programs that support community forestry.

Nepal’s community forestry program, for example, has contributed to significantly reduced average deforestation rates as well as average increases in wealth in participating villages. However, a closer look at sub-village levels, however, reveals that these positive changes in the aggregate mask a more troubling pattern beneath the surface. The sub-village analysis shows that minority and low-caste groups, who are often among the most vulnerable members of villages, were not helped by the reform; they were left behind.³⁴ Likewise, a quasi-experimental study of 174 community groups in four countries found that local villages that were exposed to forestry decentralization reforms were more likely to experience lopsided distributions of forestry products such as timber, fuelwood, and fodder.³⁵ Elite members of villages retained a disproportionate share of forest products harvested, leaving the more marginalized households relatively worse off. A plausible explanation is that to benefit economically from forestry activities villagers need access to substantial capital and labor – to log and sell timber requires equipment, hired help, and contacts with markets and poorer members of rural villages often lack access to such assets.³⁶

Taken together, these and findings of similar studies underscore the importance of examining the distribution of outcomes resulting from policy interventions, not just the central tendency, or averages. These policies led to what Perrin terms “benevolent indignities,” unintended negative effects of policies intended to help marginalized groups in rural areas.

Policies that can support reduced inequality in local governance

Of course, Andersson added, public policies can also make significant positive contributions to advance environmental justice. For example, in a recent paper, Andersson and colleagues show that forest user groups that hold formal collective titles to forest lands enjoy stronger group cohesion, intragroup trust, and more effective cooperation, even outside the forestry domain.³⁷

Compared to similar groups who do not hold such formal rights, these user groups also exhibit significantly higher levels of benefit sharing of forestry goods and products among group members (more equal distribution of benefits). Interventions that provide economic incentives for forest conservation can also help sustain cooperative behavior and reduce intragroup inequalities. Andersson cited an experimental study, using behavioral games, which showed that collective payments for forest common conservation ushered in significantly more forest conservation behavior, an effect that was sustained even after payments stopped.³⁸ The collective payments helped participants realize that there is a better way of doing things that make them all better off, a strategy that became their dominant strategy even after payments stopped.

Another set of behavioral experiments demonstrated that even better outcomes may be achieved when collective payments are combined with progressive gender quotas (ensuring gender parity). Such interventions resulted in significantly more forest being conserved and more equality in the distribution of forest income.³⁹ These findings suggest that just as some policy interventions widen the gap between the richer and poorer members of societies, other policy interventions can help to close this gap.

Andersson reported his finding that local institutional arrangements that exist among the targeted beneficiary groups are crucial for implementing successful policies. For example, the extent to which forestry decentralization augments existing inequality patterns depends significantly on the strength of the local groups’ cooperative institutions in forestry; when groups have strong collective institutions, decentralization does not widen the inequality gap.⁴⁰

Paying attention to local institutional arrangements on the ground, Andersson concluded from these findings, will therefore help researchers understand the complex effects that public policies often have on human behavior and resulting patterns of inequality.

One policy design feature that may contribute to greater socioeconomic equality is targeting the group (village, user group, or community) rather than the individual. The interventions for collective land rights and conservation payments followed this design feature. Future research would benefit from testing this hypothesis.

From evidence to action on more inclusive governance

These findings, Andersson said, have helped to develop a more nuanced understanding of how the effects of public policies are filtered through local institutional contexts. Policy interventions appear effective when examining average effects in the aggregate, for example, but such averages can mask an unintentional widening of socioeconomic inequalities. While this knowledge about the impact of specific policies seems useful for policy analysts concerned with sustainability and environmental justice, it is not obvious that this new knowledge has influenced public policy and action.

Has this evidence led to any new policy or practice on the ground? It is hard to say. The strategy that Andersson’s team has taken to encourage such reforms is to engage with boundary spanning organizations, such as the Center for International Forestry Research (CIFOR), the International Food Policy Research Institute (IFPRI), and other members of the Consortium Group for International Agricultural Research (CGIAR)—organizations whose researchers stand with one foot in the research world and another one in a variety of policy arenas.

CGIAR Research Centers are non-profit research organizations that employ more than 9,000 scientists, researchers, technicians and staff with a physical presence in 48 countries in the Global South, conducting research that aims to “transform food, land and water systems in a climate crisis” (CGIAR 2022). These CGIAR researchers represent one of the primary target groups for Andersson’s research team, which collaborates with several individual CGIAR researchers, often involving them as co-authors. These collaborations have provided more visibility for our research in more policy-oriented venues and meetings, Andersson reported, and have arguably shaped the messaging of these organizations vis-à-vis decision makers. “We have some evidence of such messaging, especially when it comes to issues surrounding industrial tree plantations, collective payments for forest commons conservation, gender quotas, and the use of multistakeholder platforms (MSPs) to promote more inclusive governance in forestry,” he added.

“Forests worldwide are vital to achieving many of the 2030 United Nations (UN) Sustainable Development Goals and the larger imperative for humanity to shift rapidly toward a just sustainability transition,” writes **Dan Miller**, in his paper on “Forests and a Just Sustainability Transition.” Such a transition, he said at the conference, will require moving away from our current unsustainable path and toward decarbonized, ecologically sustainable societies and economies that share equitably in the burdens of environmental

change while ensuring no one is left behind. The classic Brundtland Commission (1987) definition of sustainability – “meeting the needs of the present without compromising the ability of future generations to meet their own needs” – challenges us to maintain Earth’s life-supporting ecosystems while also enhancing human well-being and advancing social equity.

The environmental contributions of forests are generally well-established, Miller noted, even as there is much to learn in this era of rapid change.⁴¹ Forests are popularly understood as “the lungs of the earth” —they perform essential climate regulation functions and store about one-quarter of all terrestrial carbon. They also harbor some 80 percent of terrestrial biodiversity and help ensure water quality and supply from local to global scales.⁴² That forests are under threat across the globe is well known, he added. Fire, agricultural expansion, logging, and urban sprawl, among other drivers of deforestation, are rapidly degrading the ability of forests to deliver these critical ecosystem services and functions.⁴³

The global community has increasingly recognized the importance of forests and developed goals and policies designed to protect them. In 2021, 145 countries holding over 90 percent of the world’s forests committed to halt and reverse deforestation by 2030 and donors have pledged nearly \$30 billion to help realize this goal.⁴⁴ Forests also feature prominently in the environmentally-focused SDGs, especially Goal 15 (Life on Land), which includes targets that explicitly refer to the protection and management of forests, but also Goal 6 on water and sanitation, and Goal 13 on Climate Action. Mangroves and coastal forests are also clearly relevant to Goal 14 (Life Below Water). “But forests have relevance to achieving most, if not all the other SDGs as well,” Miller writes. Eleven SDGs, including 19 targets, are explicitly related to forests and forestry. Other SDGs are also clearly relevant.⁴⁵

While forests can help advance many SDGs, Miller added, some forest-related activities may inhibit the achievement of others. At the same time, some efforts to advance the SDGs can have a negative impact on forests. For instance, increases in agricultural production needed to achieve SDG 2 (No Hunger) or bio-based energy SDG 13 (Climate Action) will put further pressure on forests. However, forest conservation may constrain the land available for such production. Extraction of valuable forest resources, such as timber or gold or other precious metals, may increase inequalities, contrary to SDG 10 (Reduced Inequalities), as local communities suffer the consequences of resource loss while the benefits accrue in distant capitals.

Professor Miller proceeded to introduce three interlinked research areas in relation to forests: poverty, trade-offs, and financing.

The Role of Forests in Poverty Alleviation

Forests have an important but overlooked role to play in eliminating extreme poverty globally by 2030 (SDG 1). Such was the main conclusion of a global synthesis report

published by the International Union of Forestry Research Organizations (IUFRO) and presented at the UN (virtually) during the Covid-19 pandemic in 2020.⁴⁶ Since then, research, if not policy action on this topic has moved quickly. For instance, advances in remote sensing, computing power, and machine learning are enabling new insights about poverty and forest dynamics across scales, from 1-square-meter-pixels to the globe.⁴⁷

These advances promise to help address one of the major research needs identified in the IUFRO report: *how and under what conditions might forests provide a pathway out of poverty and prevent people from slipping into poverty?* Answering this question, Miller averred, will require a range of methods, from large-scale spatial analysis to in-depth qualitative research in specific locations to randomized controlled trials (RCTs) of poverty-related interventions in forest landscapes. Regardless of method used, research must be designed to examine the temporal dimensions and dynamic nature of forest-poverty relationships, particularly over longer time periods and across different contexts and spatial scales. Doing so will fill a major need given that available research mostly consists of observational cross-sectional analyses.⁴⁸

Such research, Miller argued, must also take seriously poverty as a multidimensional phenomenon comprising health, safety, food and education, social relations, and other aspects beyond monetary measures. Approaching this topic from the perspective of human well-being and prosperity rather than deprivation is a promising analytical and rhetorical strategy.⁴⁹ Doing so directs attention not only to the most disadvantaged but also to people across the poverty/well-being spectrum and may help bring forests into larger discussions about human development while directing greater attention to inequality (SDG 10). Such an approach must not gloss over real material and other deprivations facing vulnerable, forest-reliant communities.

A new project on “Innovating Pathways out of Poverty in Rural Forested Landscapes,” funded through the Pulte Institute and the Notre Dame Poverty Initiative, directly responds to the above research needs, Miller reported. This project seeks to carry out a large-scale RCT of forest-related interventions designed to reduce poverty while conserving the resource base coordinated across tropical forest regions in three countries: Peru, Kenya, and India.

Navigating Trade-offs in Relation to Land and Power

If further research is needed on how forest conservation, management, and restoration can be synergistic with poverty alleviation, Miller stated, there is also a need to understand potential trade-offs. This need extends beyond the relationship between forests and poverty to include most of the other SDGs and larger land use policies and practices.

Take climate action (SDG 13), for example, Miller suggested. Forests are unique in that they

can both cause climate change and support solutions. Standing forests capture and store carbon from the atmosphere, while clearing forests for agriculture or buildings releases GHG – but also might be necessary for land-intensive renewable energy like wind and solar farms or to mine minerals necessary for a clean energy transition. Forests are also critical for adaptation to climate change. They help stabilize local climate, protect coastal areas and mountain slopes, and provide food, fuel, fiber and other resources for forest-adjacent communities in the face of climate threats.

Governments, corporations, and civil society organizations around the world are increasingly embracing “nature-based solutions” like sustainable forest management, conservation, and restoration to tackle climate change while also delivering other benefits to human development.⁵⁰ “Yet these solutions remain controversial due to extensive land use and questions of sovereignty – including when, where, how, and for whom proposed solutions are effective and just,” he writes. Such concerns have long been present in land management. For example, the founding of national parks and other protected areas on the traditional lands of Indigenous Peoples and local communities has led to human rights violations and other forms of injustice.⁵¹

Realizing the SDGs and making a just transition to sustainability will require identifying potential trade-offs and synergies as well as careful analysis of power relations — who might stand to benefit or lose as they are negotiated.

Priority must be given to those who are most vulnerable to climate and ecological crises and to actions proposed to address these crises. Research from political science and other disciplines can help understand possible means to dislodge and disrupt powerful vested interests that are acting in ways detrimental to people and the environment.⁵² More generally, such research can help identify governance arrangements for navigating trade-offs in light of the demands of justice.

Systematic analysis of joint social, economic, and environmental outcomes and the processes that generate them across space and time is also needed to underpin and inform such research, Miller added. Such analyses remain rare. Instead, the vast majority of research in multiple social and environmental disciplines focuses on single outcomes.⁵³ This work can enable assessment of trade-offs over time—through discount rates, for example—but provides little guidance to understand and navigate trade-offs across the different dimensions of sustainability.

New research in progress seeks to address this gap by bringing together studies of two or more joint social, economic, and environmental dimensions in forest and other terrestrial social-ecological systems. It examines how heterogeneities in social, economic, and environmental sustainability domains are distributed spatially, how they relate to each other (e.g., joint positive outcomes - synergies; or positive outcomes in one dimension

accompanied by negative outcomes in another - trade-offs), and how they change over time in relation to policy, socio-economic and biophysical changes.

A deeper understanding of relationships across sustainability domains, and their co-benefits and trade-offs, is especially important in the context of unprecedented financial commitments governments, international donors, and private foundations are making to support sustainability agendas (e.g., the Glasgow Climate Pact at COP26, the Loss & Damages fund at COP27 and the 30x30 agenda at the CBD COP15). These investments typically focus on single policy objectives, often with assumptions about multiple co-benefits with little evidence for how outcomes in one dimension relate to outcomes in other dimensions. For example Miller noted, it is unclear if forest restoration efforts will yield predominantly positive social outcomes in addition to expected environmental outcomes. Similarly, investments in social protection may improve economic wellbeing but lead to environmental degradation that undermines climate and biodiversity goals.

Financing a Just Sustainability Transition

Stabilizing the Earth's climate while safeguarding biodiversity will not be cheap, Miller acknowledged. However, recent research shows it is far less expensive than the alternative. For example, the likely economic damages of climate change during the next quarter century are estimated to be six times the costs of mitigating global warming (e.g., holding it to 2°C above preindustrial levels). Similarly, funding to protect and restore fragile ecosystems worldwide will need to jump to almost \$1 trillion annually by 2030 (from about \$166 billion per year now), but this is much less than the \$2.7-5 trillion in expected economic costs due to biodiversity loss.⁵⁴ Such figures are likely to be underestimates and do not account for non-monetary values or possible tipping points which may lead to potentially catastrophic change. "Nevertheless," he argued, "they help give a sense of the stakes and need for urgent action."

To date, resources to effectively counter deforestation trends and effectively manage, conserve, and restore these forests have been woefully inadequate. National governments and, in low- and middle-income countries, international aid agencies have historically been the most important sources of support for forest conservation. While these sources remain critical and donors like the World Bank are increasing their climate-related lending, private foundations and the private sector are increasingly important in shaping what happens in the world's forests and to those who rely on them.⁵⁵

In addition to dramatic increases in spending, investments need to be better spent to support forests in advancing the SDGs and larger sustainability transition. For example, only a miniscule amount of funding committed makes its way to the Indigenous Peoples and local communities who have been shown to be so effective in stewarding forests.⁵⁶

Research on the allocation and effectiveness of forest financing remains lacking, generally. The concomitant lack of evidence, particularly on changes over time and joint impacts, constrains the ability of donors and other relevant actors to set spending priorities, address previous shortcomings, and ensure accountability and effective use of resources. There are technical as well as political reasons for the relative paucity of evidence on this topic, Miller acknowledged, but this situation must change if we are to move rapidly at the scale required for a just global transition to a sustainable future where people and nature mutually flourish.

Turning to his paper on “Forests, Sustainability and Environmental Justice,”⁵⁷ Professor Miller addressed the “evidence-to-action” question of how Keough School research on sustainability might influence policymakers. “Forests are higher on the international policy agenda than they have been for decades,” he reported. “The primary reason for this attention is recognition of the critical role forests play in tackling the global challenges of climate change and biodiversity loss.” As a global commons, the world’s forests store **about one-quarter of all terrestrial carbon** and harbor some 80 percent of terrestrial biodiversity.⁵⁸ Forests are both a cause and a solution to the problem of climate change, Miller asserted. Fires, logging, and other forms of deforestation simultaneously increase CO₂ emissions while also decreasing the ability of forests to sequester carbon. Forest degradation and loss lead to extinction and the erosion of ecosystem services and functioning.⁵⁹

Without protecting forests, it will not be possible to achieve The Paris Agreement target of limiting global temperature rise to 1.5 degree C. Therefore, 145 countries holding over 90 percent of the world’s forests have now committed to halt and reverse deforestation by 2030 and donors have pledged nearly \$30 billion to help realize this goal.⁶⁰ Relatedly, the UN’s Convention on Biological Diversity has set a target to conserve at least 30 percent of the world’s land by 2030.⁶¹ Brazil has proposed an ambitious Tropical Forest Forever fund that would allocate \$250 billion annually to countries according to the amount of forest they conserve while many private sector actors have also made commitments to combat deforestation. For example, Miller noted, dozens of large agricultural commodity companies have pledged to end deforestation associated with the production of soy, palm oil, beef and cacao by 2025.⁶²

This attention to forests, while promising, brings considerable risk for many people who live in or near forests, particularly in LMICs. In these mostly tropical contexts, forests are vital to the livelihoods and well-being of hundreds of millions of people, including many Indigenous Peoples and marginalized groups.⁶³ Despite the potential of forests to alleviate poverty and advance human development by providing income, food, and a wide range of other goods and services, national and international policy has focused on the global environmental benefits of forests while largely neglecting local socio-economic ones.⁶⁴ Very few of the recent pledges mention livelihoods or other development goals for forest proximate people. Moreover, they tend to emphasize local, site-based solutions, ignoring larger scale, indirect and harder-to-tackle drivers of deforestation, climate change, and

biodiversity loss.⁶⁵ Funds thus often appear to be about “fixing” local people, rather than supporting them.

At worst, new forest conservation efforts in many LMIC directly cause heartbreaking injustice, human displacement, and even death. For example, members of the Indigenous Ogiek community in Kenya have recently been evicted from their land in the Mau Forest in the context of a carbon offsetting project supported by a United Arab Emirates-based company. This kind of “carbon colonialism” is occurring in many African countries and Indigenous Peoples and local communities across the continent and elsewhere increasingly fear such projects.⁶⁶

The big question in this critical and highly complex space is: How can the world’s forests be managed to stabilize the climate and conserve the Earth’s rich biological diversity while enhancing the well-being of those who rely on them the most? This question requires moving beyond a narrow focus on the environmental dimensions of forests, challenging as those are, to explicit consideration of socioeconomic ones. Crucially, however, this question does not merely concern survival or “doing no harm.” Rather, as Pope Francis argues, it demands a focus on justice and richer notions of human flourishing aligned with integral human development and ecology.

From research to action on forest livelihoods

Research is therefore urgently needed, Miller declared, on the socio-economic contributions of forests, the environmental justice issues surrounding them, and how these aspects, in turn, connect to biophysical aspects. Conceptual advances and robust evidence from a more representative range of the world’s forests, along with the social, economic, and political contexts in which they are embedded, are vital for enduring solutions to climate change, biodiversity loss, and other challenges such as poverty. Such new thinking and knowledge are needed to help identify synergies and navigate trade-offs as well as provide insights into what works and what does not. From a pragmatic perspective, policies and practices designed to address environmental challenges that do not promote human dignity and capabilities or, worse, violate human rights are costly and are unlikely to last. From an ethical perspective, they are profoundly unjust and intolerable.

The Forests & Livelihoods: Assessment, Research and Engagement (FLARE) Network⁶⁷ has emerged in response to this challenge. Established in 2015 at the Paris Climate Summit and based in the Keough School since 2021, FLARE seeks to advance knowledge at the intersection of forests and livelihoods and facilitate its application to policy and practice. FLARE is now a vibrant community of more than 1200 researchers, practitioners, and policymakers around the world. The Network leverages existing expertise and catalyzes new efforts to develop and share leading-edge research and conversations on livelihoods related to forests and tree-based systems. In so doing, FLARE seeks to support policy development, on-

the-ground action, and learning to help bring about more just and sustainable futures for both people and forests worldwide.

One of the reasons why land use policy in so many countries has failed to prioritize conservation, sustainable management, and restoration of forests, Miller explained, is the relative paucity of evidence on the role of forests in supporting human development goals. FLARE researchers have sought to address this gap through new empirical studies and evidence syntheses. For example, studies from Nepal, India, and Liberia have taken advantage of large-scale household survey data combined with forest cover data to shed new light on the nature and scope of forest contributions to household income and consumption.⁶⁸

A global synthesis of evidence on the contribution of forests and trees outside forests to poverty alleviation noted the existence of many site-specific case studies but found little evidence at the regional and national scales, which hold particular relevance for policymaking.⁶⁹ That report led to advances in conceptualizing forest-poverty dynamics while highlighting a glaring gap in knowledge on how and under what conditions forests might provide pathways out of poverty.⁷⁰ It did, however, identify 21 policy levers having potential (i.e., a plausible theory of change) for poverty alleviation based on forests.⁷¹ Evidence was the most robust for ecotourism, agroforestry, payments for ecosystem services, and community forest management levers, with the last of these found to be especially promising. Community forest management occurs when communities have some degree of rights and responsibilities over forests in a given area.⁷² This form of management has existed in various forms around the world for centuries, but has increasingly been promoted formally by governments, donors, and community organizations alike as a means to conserve forests, enhance rural livelihoods, and recognize the traditional rights of local forest users in relation to forests.⁷³

Indigenous Peoples, Afro-descendant Peoples, and local communities now number some 2.5 billion worldwide and customarily hold and use at least 50 percent of the Earth's lands.⁷⁴ These groups have been shown to be among the most effective stewards of the world's forests. "For this reason, as well as reasons of self-determination and (restorative, transformative) justice," Miller writes, "strengthening their rights and resources must be at the center of forest-related policy."

Yet, while recent research has demonstrated that community-based approaches can improve rural communities' access to formal property rights and reduce environmental degradation, there is less evidence that they have contributed to lasting improvements in measures of human well-being. For example, there have been no randomized controlled trials (RCTs) examining the poverty outcomes of community forestry efforts in the LMIC.⁷⁵ In the few cases where RCTs have been used related to forest programs, poverty is not among studied outcomes.⁷⁶ There is, therefore, a particular need for experimental evidence to

better establish poverty impacts, but also examine the relationship of such impacts with environmental one across different contexts, Miller said.

Such research, he added, must be co-produced and carried out in partnership with local communities who, in most LMICs are under enormous pressure from policy, market, and environmental change. Even as Indigenous Peoples and local communities have increasingly gained formal recognition of rights to their traditional territories (an estimated 30 percent of forests in low- and middle-income countries are formally owned or managed by such communities), countervailing trends toward “green grabbing” and other appropriation of their lands pose a growing threat.⁷⁷

This threat has materialized in too many cases, with communities evicted from their lands in many cases and environmental defenders being killed, tortured, or subject to laws that are weaponized against them for speaking out.⁷⁸ International environmental agreements and shifting market demands (e.g., in carbon credits or for minerals like copper, cobalt, and lithium critical to clean energy technologies) are increasingly driving these human rights violations. In this context, forest-proximate communities are increasingly demanding not only formal rights over their ancestral and traditional lands but also the ability to benefit from them.

The FLARE Network is directly responding to these pressing contemporary forest, development, and justice issues— first, by using new datasets and tools to analyze relationships between human population, human development, and forests globally over time. The methodology combines global-scale remotely sensed data on tree cover, gridded human population data, and gridded wealth and human development data to identify forest-proximate people in poverty (“FP3”). Results are presented as global and country-specific maps to enhance their relevance for forest and land-use policy across scales, from particular sites or regions within countries, the national level, or internationally. Such information can inform policy design and targeting (e.g., by illustrating who and how many people would be affected by policy decisions in what social-ecological contexts) and efforts to navigate potential tradeoffs between forest conservation and restoration actions and poverty alleviation goals. Identifying areas with high levels of poverty and forest loss is of particular interest, given the need to simultaneously address these two challenges.

A second major FLARE effort to connect research to policy is through a project to rigorously establish the joint poverty-environment impacts of innovative community-level policy interventions in LMIC. The heart of this project, which is funded through the Pulte Institute and Notre Dame’s Poverty Initiative, is a large-scale RCT of forest-related interventions designed to reduce poverty while conserving the resource base coordinated across tropical forest regions in Peru, Kenya, and India. Through a co-produced research process with community, business, government, and research partner organizations, FLARE is developing and testing a set (3-4) of interventions that existing theory and evidence

suggest are capable of simultaneously increasing rural prosperity and equality while conserving vulnerable forest landscapes. Likely interventions will relate to community forestry enterprise support, payments for ecosystem services (e.g., water and carbon sequestration), and provision and training on entrepreneurial skills. By engaging with key stakeholders, including potential funders, from the project design phase, FLARE seeks to extend these findings to policy-relevant audiences.

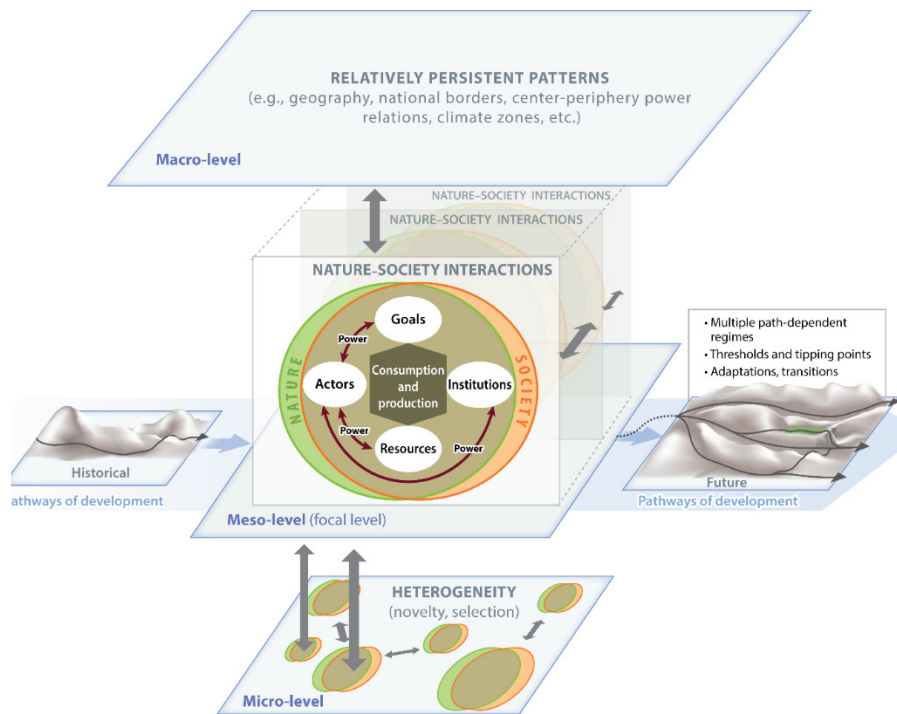
In addition, Miller reported FLARE has developed a CommFor (community forestry) tool, which builds from the International Forestry Resources and Institutions (IFRI) research program and leverages digital technology customized as smartphone and desktop-based applications to capture data at high and varying frequencies, reduce the burden of data collection, and generate real-time insights for use by local communities in forest governance.⁷⁹

CommFor presents multiple advantages to support community-based forest governance, Miller explained. First, insights from data become available in near real-time and are directly usable by local communities and their federations in making decisions. Second, data can be shared with external actors, such as government agencies and private businesses, to build trust in community institutions for forest governance, as well as with practitioners to support communities in forest management and with researchers to advance knowledge on forest commons. Finally, CommFor can enable visibility of landscape-level outcomes for greater recognition of community contributions to addressing global challenges, such as forest landscape restoration, biodiversity conservation, and climate mitigation.

In such ways, Miller concluded, FLARE is responding to the major contemporary challenges related to forests. In so doing, the Network seeks not only to build knowledge, but also empower communities, equip advocacy organizations, and inform policymakers to cultivate a world where forests and people, especially the most marginalized among us, are able to mutually flourish.

William C. Clark of Harvard University prepared and delivered a paper entitled “Sustainability and Integral Human Development at the Keough School,” in response to the papers by professors Miller, Andersson, Grubert and Winters. “The discussion of sustainability issues in the Keough School’s Strategic Plan and conference presentations provides a rich and original perspective on a central challenge in global affairs,” he noted. Clark then provided a sustainability science perspective on the Keough School program on sustainable development.

Sustainability science is a vibrant field of problem-driven research, he began, that has emerged over the last quarter century to support the pursuit of sustainable development. Along with his colleague Dr. Alicia Harley, Professor Clark had recently reviewed progress in the field and sketched its principal challenges going forward.⁸⁰ The synthesis presented in that review is summarized in this figure:



Clark WC, Harley AG. 2020.
Annu. Rev. Environ. Resour. 45:331–86

At the core of both sustainability science and the Keough School sustainability program Clark said, is the realization that nature and society are intertwined in a single dynamic system: one cannot advance human well-being over the long run without conserving the environment, and one cannot conserve the environment over the long run without advancing human well-being. (The Brundtland Commission recognized this reality in its seminal 1987 report on sustainable development.) The spiritual importance of embracing the fundamental intertwining of nature and society has been eloquently articulated by Pope Francis in his encyclical *Laudato Si*. The active embrace of this fundamental insight in the Keough School’s sustainability work, Clark stated, positions it well to contribute to and draw from ongoing research in sustainability science. The most novel and welcome feature of the Keough School’s efforts from the perspective of sustainability science, he added, is the school’s focus on promotion of the flourishing of *people* as its ultimate goal:

This [focus on human flourishing] sets the Keough School apart from almost all other global affairs institutions where the (sometimes implicit) goal more often turns out to be the prosperity of *economies* or the security of *nations* or protection of the *environment*. In contrast, the Keough School’s focus on ‘integral human development’ not only makes it different from its cousins, but also aligns it well with the similar concept of ‘inclusive human well-being’ that is the core goal of sustainability science. In both cases . . . the crucial step has been to insist

on distinguishing the ultimate ends from the proximate means of sustainable development: the ends as human-centered, the means – essential, but means nonetheless — as entailing the economic and environmental underpinnings of human flourishing. This essential ends-means distinction was clear in the Brundtland Commission’s original work on sustainability but was bargained away in the UN’s subsequent negotiations to create its SDGs.

The result has been a “something for everyone” approach in which (for example) “poverty alleviation” and “partnerships” are given equal status as sustainability “goals,” with no accompanying guidance on how priorities and trade-offs are to be managed. The Keough School’s Strategic Plan, by focusing on IHD as its ultimate goal, offers a potential way out of this mess that is entirely consistent with the “well-being” goal of sustainability science, Clark asserted. Most of the individual papers presented at this conference, he continued, have tried hard to realize that potential and have often been successful. But they “occasionally backslide toward a confusion of ends and means,” allowing the appropriate attention to means for achieving sustainability to come across as looking like the ends or goals for sustainability.

In the school’s focus on forests, for example, the goal of advancing the well-being of people in forests through conserving forests as resources “can too easily slide into advocacy of forest conservation as the end goal rather than as an important means for achieving IHD.” This problematic tendency is accentuated, Clark suggested, by how “integral ecology” is advocated for in *Laudato Si’*. He put the challenge elegantly:

The Keough School will have to struggle to put into practice a Strategic Plan that keeps IHD as its end goal; it will be important for the successful pursuit of sustainability that the struggle persists and succeeds.

Professor Clark articulated two concerns about the way that “Justice” — “a major and welcome component” of the Keough School efforts to advance sustainability—is presented. First, he said, the concept is “surprisingly underdeveloped” in the Strategic Plan and the participant contributions. They all “tend to read as though ‘justice’ were an unproblematic ‘thing’ like a rock or a pencil when, in fact, the idea of justice is a complex construct that is viewed differently in different times and contexts.” In particular, the problem of justice for future generations deserves more attention than it gets in the Keough materials. “Intergenerational equity,” Clark noted, was a central element of the Brundtland Commission’s original vision of sustainability goals, and it was the subject of a highly relevant study on “intergenerational solidarity” by the Pontifical Academy.⁸¹ The Keough School’s sustainability initiatives would almost certainly benefit from drawing on this material.

A second “justice”-related concern is about the term “environmental justice.” Despite the use of this term in the conference publicity, Clark noted, the individual papers almost never refer to “environmental justice” but rather develop a more general treatment of (in)justice. Taken together, the papers make a strong (if generally implicit) case for the inseparability of “environmental” justice from “social” justice and indeed from simply “justice.” This is the right way to go, Clark advised, given the aforementioned intertwined character of the nature-society system: one cannot pull apart the contributions to (in)justice that derive from either part. For example, while it is true that some subpopulations are exposed to more pollution than others, this will almost always be linked to the fact that their options on where to live have been constrained by unjust redlining or wage discrimination.

The Keough School program, he averred, would be well served by ditching the phrase “environmental justice” and focusing on ‘(in)justice,’ per se, together with the intertwined social and environmental factors that give rise to it.

Resources as the ultimate means of sustainable development

A central finding of sustainability science, Professor Clark noted, is that the ultimate determinants of sustainability – and thus the ultimate means of promoting it – are the underlying resources on which people draw to enhance their well-being. Those resources, however, include not only the familiar ones built by people (manufactured capital, human capital, knowledge capital, social capital) but also those derived from nature (minerals, ecosystems, the physical environment, solar radiation). The latter has historically been excluded from most measures of “economic development,” and their inclusion in more modern measures of sustainability has been one of the great accomplishments of today’s “beyond GNP” movements to capture a more human-centered view of development.

Sustainability has indeed come to be defined by scholars as development pathways along which the capacity of the *total* accessible resource stock to support human flourishing does not decline. While the Keough School Strategic Plan and conference papers include the conservation (and indeed nurturing) of natural resources in their treatment of the means to pursue sustainability, Clark noted, “they too often take this to the extreme of ignoring the full range of human-created resources that are also necessary for sustainable development.” This conceptual narrowing undermines the possibility of analyzing the inevitable trade-offs among all relevant resources. For example, under what conditions is the pursuit of sustainability advanced by a decision to cut down a hectare of rainforest to build a region’s first hospital? The Keough School program, Clark urged, “will almost certainly be more useful to the extent that it can foreground a balanced view of both people-made and natural resources in its analysis of means and their trade-offs for the pursuit of sustainability.”

Consumption-Production Systems (for connecting ends and means)

Sustainability science sees consumption-production systems (CPSs), broadly conceived, as the arrangements and processes that people design to link their ends (goals) and means (resources) of development. Research has analyzed such systems by sector (e.g., mobility systems) or by place (e.g., rural development) or – most commonly – by a particular sector in a particular place (e.g., mobility systems in Rome).

A general consensus has emerged, Clark explained, that the sustainability analysis of such systems should address both the consumption and production aspects, rather than focusing on only one or the other. While the Keough School program and conference papers seem reasonably well aligned with these sustainability science perspectives, the paper by Emily Grubert introduces an additional “service-first” argument, which holds that in order to move beyond a descriptive characterization of the CPS toward a normative analysis consistent with goals of IHD (or “inclusive well-being”), one needs to foreground the consumption end of the CPS. This is done to ensure that the flow of services that are the core constituents of human well-being is not (however unintentionally) sacrificed in the course of changes to production processes and their use (conservation) of resources.

This strikes me, Clark said, as “a compelling addition to how we think about sustainability, with implications not only for analysis and design of interventions but also for another broader theme of the conference: the language for how we talk about things.” In particular, it constitutes “an argument for foregrounding references to ‘food systems’ rather than ‘agricultural systems,’ i.e. biasing our naming the systems we study to emphasize human well-being (food) rather than the production methods we use to generate those services.” Or, he continued, to take a more problematic case central to the Keough School efforts, calling them not “forest systems” but rather something like “livelihood security systems” for people who live in or near forests. “This is a perspective from the Keough School conference,” Professor Clark concluded, “that I will certainly take back to my sustainability science community for collective pondering.”

Actors, institutions and power for operating consumption-production systems

Sustainability science was slow to systematically address questions of who gets what from the operation of consumption-production systems, Professor Clark observed. That has recently changed, however, and a lot of writing – if not quite so much research – is being done on the relationships among actors, institutions and power:

One insight to which the Keough program might usefully devote more attention is that because nature-society systems are complex adaptive systems, large inequalities in outcomes are the norm. Indeed, we know that with all such systems, initial heterogeneities in access to resources generate self-reinforcing feedback that leads

to greater and greater inequalities in outcomes. Differentials in power among actors can (and do) accentuate such inequalities but are not necessary to generate them. Goals such as those of sustainable development, which emphasize more equitable and just outcomes can therefore only be achieved through strong and continuing interventions and institutions designed to counter inequitable concentration in who gets what (e.g., progressive taxes on wealth, redistributive transfer payments, prohibitions on monopolies, etc.).

Above all, evidence suggests that countering inequalities in CPSs requires empowerment of those who are currently losing out. Such empowerment must begin with researchers treating actors as “agents not patients” (a phrase attributed to Amartya Sen) and helping them to achieve a meaningful voice in sustainability debates. “The Keough School Plan and conference papers do not seem at odds with these insights, but neither do they give them the central place that considerations of actors, institutions and power now hold in sustainability science,” Professor Clark commented. “The Keough School’s program might find it worthwhile to reflect on whether more emphasis on these and related issues would be possible and helpful.” Reciprocally, however, Clark’s encounter with the Keough School sustainability effort suggests that its explorations of human dignity “could well enhance how sustainability science thinks about peoples’ ‘capabilities’ to define and achieve their own goals.”⁸² These linkages, he added, both potential and realized, “are some of the most thought-provoking things I will take home from the conference.”

Recognition of the ways in which nature-society interactions and efforts to manage them depend on the specific social and local context has led researchers and policy actors to focus much of their sustainability work on consumption-production systems in particular sectors and places. This localization of sustainable development is entirely appropriate, Clark noted, and is well reflected in both sustainability science and the Keough School conference contributions. That said, we live in a globalizing world where local places are increasingly connected. Those connections may involve physical pollution, ephemeral ideas, biotic invasions, economic trade, human migration, transboundary negotiations and all manner of other processes.

Sustainability science was slow to incorporate systematic attention to such connections in its research. The Keough School presentations show some of the same characteristics, Clark argued. “That is, none seem to deny the potential importance for sustainability of connections for sustainability across local contexts, but few of the sustainability studies highlighted such connections in the short summaries given of their work. (One exception is the attention paid in other parts of the conference to the importance of *international* agreements on norms of human rights).” Sustainability science is beginning to remedy its early neglect of connections by increasingly addressing “nexus” interactions among different CPSs, (e.g. when an energy system and a food system in a particular place both seek to use the same water resources to achieve their goals). I suspect that the Keough

program on sustainability would likewise benefit from more systematic attention to connection processes and their impacts on local contexts, he concluded.

Transitions in the development pathways of CPS dynamics

Fostering transitions from unsustainable pathways of development toward more sustainable ones that are more likely to achieve the goals of IHD is perhaps the ultimate challenge, Professor Clark averred. Too little of the otherwise welcome cheer-leading for “sustainability transitions” in political forums is grounded in science. For the pursuit of sustainability, an especially significant characteristic of the intertwining of nature and society is that their interactions result in a particular case of the more general phenomenon of a “complex adaptive system.” Such systems self-organize in a hierarchical fashion, he explained, with their dynamics at whatever mesoscales interest us being shaped by both micro-level innovations (e.g. mutations, inventions, policies) and macro-level trends (e.g. economic globalization, climate change). Those dynamics have the potential for following multiple path-dependent trajectories, some of which may be sustainable and desirable, others less so. Those alternative pathways are generally separated by thresholds or tipping points, the navigation of which should be a focus of science-informed discussions of sustainability transitions.

The Keough School Strategic Plan and presentations seem generally consistent with this view of transitions, Clark judged, although – as is the case with sustainability science more generally – more research attention could usefully be given to exploring alternative pathways (for energy systems but also demographic systems, food systems, forest systems, etc.), to assessing how likely those alternatives are to foster the goals of IHD, and to exploring the incentives for innovation that might make desirable transitions more readily achievable.

That said, “the insight from the conference presentations that most rocked my own understanding of a topic I thought I knew well is Prof. Grubert’s “mid-transition” challenge for the energy transition.” In essence, he continued, this poses the dilemma faced by society during a multi-year or -decade transition when it must maintain the capacity to deliver key human services from the old system it is trying to replace even as it builds the capacity to deliver those services from the new (presumably more sustainable) system. The challenge is that balancing on the “ridge” separating the two pathways for extended periods will be necessary but could well put society in a more precarious and less stable situation than it would face when firmly situated in either of the pathways alone. Simultaneously securing human and infrastructure resources needed for the delivery of key services from both systems is a challenge barely posed and certainly not answered in current discussions of sustainability transitions.

“I will certainly take the ‘mid-transition’ challenge back to the sustainability science community,” Professor Clark concluded. “I very much hope that the Keough School program will find a way to foster both the deepening of Grubert’s pioneering work on the mid-transition challenge for sustainable development of the US energy system and the extension of research on that challenge to other sectors and regions.”

In his comments on the papers by Miller and Grubert, **Subhrendu Pattanayak** underscored “the extremely delicate balance” between meeting the goals for avoiding the most catastrophic consequences of climate change and not falling below the bar of social justice. Miller and Grubert, in addition to mastering the technical, scientific and data-driven aspects of the topic are also doing what few of their colleagues are attempting, namely, turning a critical lens on the social implications of climate solutions, especially for the working class and the poor.

He raised a few quibbles: Regarding FLARE network, Miller and his colleagues must avoid relying too much on experimental methods and RCTs, which may undermine the multidimensional approach. Using multiple methods, Pattanayak said, is necessary to address such a complex problem as forests and livelihoods under the current dire conditions. As for Grubert’s paper, he cautioned, giving up “dirty fuels” is less than a straightforward process; for example, we know that people “stack,” that is, they use new forms of energy and practices, while also still using some of the old ways. Grubert gets at this, a bit, in her paper, he acknowledged, but learning from her wrestling further with such psychosocial dimensions of the “just transition” problem would be instructive to us all.

Professor Pattanayak concluded with some advice for the Keough School, namely that research in this area must be based on “inclusive science,” that is, perspectives and data from the Global South; ninety-plus percent of the research is currently conducted by white men from the Global North, whose perspectives and experiences are different from that of those most affected by climate change. Those who are most affected must also be included in the research itself. Relatedly, he added, scholarship shows that policy uptake is more effective if local actors are involved in the research and are continuously available to local officials.

In the discussion session that followed, **Michel Hockx** noted some skepticism within our own broader Notre Dame community about the science on climate change— which leads one to ask whether we should focus our attention as educators and advocates of just sustainability on our own respective communities of learning. Grubert concurred with the premise of the question, noting that some civil engineers, stunningly, are included in the skeptical group, which is why she has focused her efforts on the US. Ansari, noting that climate change is a political and partisan issue asked how we get around that stark reality. Miller responded by recalling a rare bipartisan agreement, during the first Trump administration, around the Natural Resources Management Act, approved by the US Senate

98-0. The term “climate change” was avoided in the debate, however, and that is perhaps a lesson for us in reaching common ground, he said. There may be more scope for agreement than we think. Yet, Miller also added, we cannot forget that power and interests drive the “skepticism,” and unmasking or laying bare those interests is part of the challenge.

Along this line, Pattanayak commented that scientists and other educators would do well to connect the science and climate change to the concrete problems of humanity—migration, displacement, climate-driven homelessness, jobs, fairness. How climate affects people and living is the topic that would advance the argument more effectively.

Winters, noting Professor Clark’s emphasis on justice and future generations, and many conference comments on focusing on local decision-making, raised a dilemma based on his experience representing the UN in asking local African leaders to comply with certain environmental standards and protocols, namely, that “their” issues are not always “our” issues. As one African leader told him: “I care about hunger, not climate change in itself.” Do we insist on the whole package, anyway? Professor Pattanayak responded by saying that if we do not recognize the value of what [our African interlocutors] are saying, unhelpful controversies result. However, it is also our job to demonstrate the connection between climate change and hunger, climate change and poverty, etc. Unfortunately, he added, the relationship has been so one-sided, with the West telling the rest what to do, that the imperative must be to create equal partnerships.

Once you acknowledge what your interlocutor cares most about, Clark said, then you can together move on to determining what can be done about it, and that brings you into the related issues that also need addressing, in order for one’s core issue to be solved.

In her comments on the papers by Winters, Andersson and Miller, **A.R. Siders** reminded the audience that “environmental justice” started as a movement and a practice, not a theory.⁸³ So, as researchers, are we conducting research that helps practitioners make decisions that lead to more just practices, processes and outcomes? In addition to the two ways of engaging identified by Krister Andersson—identify injustices and give priority to stakeholders on the ground—Siders added a third, namely, we can do research on what environmental justice means in different contexts so that we can assess *how* different policies are achieving those goals, and advise people how better to reach those specific goals. Greater specificity is needed; the Keough School might focus on *targetable action* for environmental justice.

Picking up on Clark’s point about using the right language to advance the argument, Siders noted that the much-used term “distribution”—of opportunities, outcomes, harms, resources, risks, etc.—is often used in speaking of justice but often with procedural connotations. But we could and should also measure “recognition”—whether people have a voice to participate in decision-making processes—what do *they* want, what are *their* preferences for

how they get out of this situation—and how programs recognize the historical and cultural contexts and values.⁸⁴ Not every community or group will have the same desired outcome. Advancing IHD and inclusive well-being, she said, requires following The Platinum Rule—treat others as they would want to be treated. Reparations and restorative justice are critical in this respect, as past climate and other social injustices cannot be overlooked.

Siders echoed Clark’s comments on the complexity of understanding justice and what it requires. Helping people thrive is central to IHD and the Keough School proposals, but people will have different views on what “thriving” looks like, so any effort. She drew on her research on climate adaptation to illustrate how different people can disagree on what constitutes a “just” response.⁸⁵ Residents often disagree about whether to rebuild or relocate after a major disaster. Some see relocation as an opportunity to advance justice by addressing the past social injustices that drove segregation and contributed to inequities in home ownership and value. Others see relocation as continuing that discriminatory history. People are often divided on the question: should people be able to choose to live in extremely risky places? What level of risk is acceptable? Principles like “informed consent” are relevant here and have been developed in medicine and public health but have not transitioned to development and adaptation fields. What would informed consent look like for a forest conservation project? Or a food system transformation effort? Or an energy transition? She encouraged the Keough School scholars to draw insights from other fields as they advance their work on just transformations for sustainability.

Referring to Emily Grubert’s “just transitions” discussion, Siders noted that sustainability might have an additional challenge. The future, Siders asserted, will not look like the past; we can no longer rely on a stable environment. Accordingly, rather than adapting by transitioning from one stable state (e.g., a coal-dependent energy system to a renewable energy system), many systems may remain in a near-constant state of transition and change. A coastal community facing sea level rise, for example, or a farmer facing increasing drought, will not transition once but rather will need to change at regular intervals to adapt to ongoing changes in the environment. What happens if a society or sector remains stuck in the “mid-point” transition that Grubert describes? Do the interventions we are thinking about allow for this kind of constant transition? Does a food security intervention support decisions by farmers to transition to other types of livelihoods? What bounds do interventions place on the available options? And how might an intervention be designed differently if it were designed to be changed again in the future, building in adaptability as well as sustainability?

Siders concluded her remarks by arguing that empowering local agency and control will need to be bounded if the local decision-makers are a narrow, privileged elite who only consider their own needs and leave others behind. Inclusion requires more voices in the decision-making process. On the other hand, just as Clark noted that justice is not an easy or well-defined widget to be adopted, community engagement also involves a challenging and

nuanced set of dilemmas. While many of the Keough School scholars recognize the value of empowering community decision-makers, they could do well to delve further into the justice challenges involved in this approach. One example is that efforts to empower communities are inevitably shaped by how “community” is defined – whether the community members considered in a decision include, for example, only current residents or also future generations, only male heads of household or all individuals (including children and elderly residents).⁸⁶

In the discussion that followed, Bill Clark asked about the Consortium Group for International Agricultural Research (CGIAR), whose Research Centers are non-profit research organizations that employ more than 9,000 scientists, researchers, technicians and staff with a physical presence in 48 countries in the Global South, conducting research that aims to “transform food, land and water systems in a climate crisis.” Clark questioned the panel’s portrayal of CGIAR as wanting in terms of its pro-poor, pro-people social justice dimensions.

Winters responded that CGIAR has improved on this score, mostly owing to the criticisms that they have received from researchers around the world from the time of the Green Revolution to the present. The weakness of CGIAR, he said, is the inability to scale up and to adapt as an organization to innovations such as digital agriculture. Pressing the issue, Clark asked what institutional design *would* improve upon “CGIAR-plus”? Winters replied that he is working with colleagues at the University of Chicago and the Gates Foundation to propose options and alternate models: the innovations are there, but how do we bring them to scale?

Andersson noted that CGIAR is committed to helping researchers understand how their research can be applied in a “pro-public, pro-poor” manner, and is helping to produce innovations. However, he added, we should not be under the illusion that such research networks should be expected to bring solutions to scale. The work with multilaterals is important in this regard. But we should be a bit humble about what we can do as researchers (especially if we do not consult with the farmers and others in rural areas who we are trying to serve). We researchers are part of an ecosystem of knowledge production, but we are not all suited to working closely with pastoralists and other actors on the ground. We still have an important role to play, he said, even via “blue-sky” research, and we can contribute a good deal while staying in our own lane.

Miller pointed to the impact that we researchers also have as teachers and mentors of students who will have an impact on research, teaching, policy and practice.

Sr. Alford offered a contrast between moral principles and theories, on the one hand, and the practice of virtues on the other, citing the virtue ethics of St. Thomas Aquinas. In combatting poverty and climate change, etc. we must ask: how do we apply virtues in certain specific situations and contexts? Aquinas and others do this at a meso-level, for business, the

military, etc. But we must go to the micro level by bringing the dilemmas and decisions to the people. We cannot resolve their particular problems on the general level. The people practice concrete virtue ethics, so to speak; theories are not useful to them.

In asking and expecting the community to make the decisions to solve the problems, Siders urged, one must ask, *Who is the community*—male elders? Male heads of household? Are mothers and grandmothers included? At times “the community” makes decisions that seem to undermine the common good; they recommend things that violate principles of justice (e.g., “we favor dedicating resources equally to every person,” which fails to acknowledge the pre-existing structural and cultural power and privilege inequalities) In such cases, are “agency” and “dignity” goals in their own right, or do we need to place these goals in the context of the greater good of the most people? A decision might benefit a small group of people in the short term but have harmful consequences to the broader region or to people in the future.⁸⁷ How are such issues handled? Furthermore, she asked, how do we handle conflicts between community members when such thorny questions arise?

Winters objected to the assumption that we should impose our value judgements about justice on local actors (e.g., when we insist that aid is dependent on women being integrated into the discussion, an insistence that might violate community norms and customs). Andersson described projects where gender quotas had led to increased forest conservation and increased poverty reduction. If the “science” shows that engaging women leads to “better” outcomes, should interventions be designed to promote effective sustainability and poverty reduction outcomes or to empower existing male-dominated community decision-making structures? Siders replied that we will all define “the community” differently, and that is the crux of the matter. “We cannot simply say ‘the community will decide’ and pretend that solves the problem. That is just the start of the challenge.” The questions we are raising here, she added, are a good place to begin this complex conversation and debate.

Caroline Hughes asked about scaling solutions and whether they are always unambiguously benevolent. Innovations by big biotech companies, when brought to scale, may or may not serve the common good but instead advance special interests. Power relations are always involved, as are profit motives; similar concerns accompany government scale-ups. Scaling certain centrally-developed innovations (by, say, global biotech conglomerates), in other words, may undermine social justice. There are examples of benevolent scaling, she acknowledged, but also of disastrous scaling. How do you scale up without context-specific empowerment?

Hughes made a second point, namely, that local research resources are “fragile,” in the sense that many developing countries have only a handful of researchers, with less than adequate support in some cases. So, yes, Hughes said, by all means let’s partner with and empower local researchers. But Keough School resources could also be devoted to helping *develop*

local research bases in areas where we work, thereby helping to foster a sustainable research ecosystem.

Andersson mentioned that he is a bit skeptical about having scaling be the end-all, be all goal of our research on sustainability. Given the prevailing power dynamics in many societies where we work, we must ask ourselves, “If we use the existing governance structures to bring proposed solutions to scale, who will the scaling-up benefit?” We risk widening the gaps between the richer and poorer members of societies.

Not all innovations are high-tech or scaled up by corporations, Winters noted. Small-scale producers often rely on older practices that can be revived. The problem is that these innovations are being adapted by mid-level farmers while the poorer farmers are being left behind. In terms of engaging local actors, Pattanayak noted that mapping the community is not straightforward; the process will have to rely on intermediaries, who can “translate” in both directions, between the local and the international.

Siders expressed enthusiasm for the emerging research agenda of the Keough School. As this conference and the nuanced presentations have demonstrated, she said, Keough School research and teaching are benefitting from the multiple perspectives and disciplines of the faculty, even as they are converging on certain important shared themes and points of consensus. Andersson agreed that the configuration of the Keough School, and the interactions and collaboration among the faculty “push us all to move away from our comfort zones, in order to refine the ways we put our research in service to the poor and vulnerable.”

Winters concluded the session by cautioning us not to allow our ongoing deliberations and theoretical and research refinements to delay us in providing responses to questions that demand answers now—e.g., how do we allocate the hundreds of millions of dollars being dedicated by governments and intergovernmental agencies to agricultural and environmental innovations?

Endnotes

¹ This essay is a lightly edited version of a working paper presented by Professor Grubert on May 28, 2024 at the Keough School conference, “Embracing Integral Human Development: What Difference Does it Make?”. Parts of this essay have now been published in Emily Grubert, “Carbon markets have no future in a (net) zero-emissions world,” *Dialogues on Climate Change* (2024), <https://journals-sagepub-com.proxy.library.nd.edu/doi/10.1177/29768659241300681>.

² “Aljazeera News, “First time world exceeds 1.5C warming limit over 12-month period,” February 8, 2024, <https://www.aljazeera.com/news/2024/2/8/first-time-world-exceeds-1-5c-warming-limit-over-12-month-period>.

³ Emily Grubert, “Yellow, red, and brown energy: leveraging water footprinting concepts for decarbonizing energy systems,” *Environment, Development and Sustainability* 25, (2023): 7239-7260. <https://doi.org/10.1007/s10668-022-02760>

⁴ United Nations Statistics Division 2024.

⁵ Qery, “U.S. Census Household Pulse Survey Jan-Feb 2024,” February 2024, Accessed March 29, 2024, <https://qery.no/u-s-census-household-pulse-survey-jan-feb-2024/>.

⁶ Jayanta Bhattacharya, Thomas DeLeire, Steven Haider, and Janet Currie, “Heat or Eat? Cold-Weather Shocks and Nutrition in Poor American Families,” *American Journal of Public Health* 93, no. 7(2003): 1149–1154, <https://doi.org/10.2105/AJPH.93.7.1149>. As of 2019, over three million people in the United States live in extreme poverty, or less than \$2.15/day (international dollars, 2017) – more than in China, which has more than four times the population and one fourth the per capita GDP (international dollars, 2017) (World Bank Open Data 2024). See Joe Hasell, Max Roser, Esteban Ortiz-Ospina, and . Pablo Arriagada, “Poverty,” *Our World in Data*, (2023), <https://our-worldindata.org/poverty>.

⁷ Traditional land holders have seen devastation from energy production. Whole regions are referred to as “sacrifice zones,” hosting locally unwanted land uses (LULUs) and bearing the brunt of impacts that support benefits mainly felt beyond the local areas. In the United States, burden is deeply unevenly distributed, with death and disease burdens borne disproportionately by people of color and lower incomes: Christopher W. Tessum, et al., “Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure,” *Proceedings of the National Academy of Sciences* 116, no. 13 (2019), <https://doi.org/10.1073/pnas.1818859116>. Some effects have intergenerational impacts, with evidence of heritable epigenetic changes: Anushi Shukla et al., “Air pollution associated epigenetic modifications: Transgenerational inheritance and underlying molecular mechanisms,” *Science of The Total Environment*, 656 (2019): 760–777, <https://doi.org/10.1016/j.scitotenv.2018.11.381>.

⁸ Geoffrey Supran and Naomi Oreskes, “Assessing ExxonMobil’s climate change communications (1977–2014),” *Environmental Research Letters* 12, no.8(2017), <https://doi.org/10.1088/1748-9326/aa815f>.

⁹ Joshua Macey and Jackson Salovaara, “Bankruptcy as Bailout: Coal Company Insolvency and the Erosion of Federal Law,” *Stanford Law Review* 71, no. 4(2019): 879.

¹⁰ Emily Grubert and Sara Hastings-Simon, “Designing the mid-transition: A review of me-

dium-term challenges for coordinated decarbonization in the United States,” *WIREs Climate Change* 13, no.3(2022), <https://doi.org/10.1002/wcc.768>.

¹¹ Emily Grubert, E., and Sara. Hastings-Simon., 2022. “Designing the mid-transition: A review of medium-term challenges for coordinated decarbonization in the United States,” *WIREs Climate Change* 13, no.13 (3)(2022);: e768. <https://doi.org/10.1002/wcc.768>.

¹² The mid-transition is a global problem, Grubert said, but with highly important local differences that will require focused and specific scholarship, development, and implementation to be successful. Some long-industrialized countries and regions have relatively older fossil infrastructure and significant accumulated wealth to fund transition, while others that are newly industrialized have relatively newer fossil infrastructure and potentially less capital, making it more difficult to retire assets that still have many years of useful operating life. Still others have little fixed infrastructure and also very little capital, posing challenges for implementing anything actually or perceived as untested or unfamiliar. All have specific social contexts, legacies of pollution and extraction, and specific vulnerabilities to climate change and institutional power. Regulatory structures, conventions, and financing access also vary, emphasizing the need for specificity in identifying action that can lead to more just outcomes.

¹³ Emily Grubert, “Fossil electricity retirement deadlines for a just transition.” *Science* 370, no.6521(2020): 1171–1173.

¹⁴ Jeff St. John,2023, “Clean energy is cheaper than coal across the whole US, study finds,” *Canary Media*, January 31, 2023, <https://www.canarymedia.com/articles/fossil-fuels/clean-energy-is-cheaper-than-coal-across-the-whole-us-study-finds>; Energy Information Administration. 2023. “Use of coal.” Accessed March 29, 2024. <https://www.eia.gov/energyexplained/coal/use-of-coal.php>; Emily Grubert and Frances Sawyer, “US power sector carbon capture and storage under the Inflation Reduction Act could be costly with limited or negative abatement potential,” *Environmental Research: Infrastructure and Sustainability* 3, no.1 (2023);: <https://doi.org/10.1088/2634-4505/acbed9>.

¹⁵ This point is elaborated in Grubert’s aforementioned article in *Dialogues on Climate Change*: <https://doi-org.proxy.library.nd.edu/10.1177/29768659241300681>

¹⁶ Davis, Benjamin, Leslie Lipper, and Paul Winters, “Do Not Transform Food Systems on the Backs of the Rural Poor,” *Food Security* 14, no. 3 (2022): 729–40. Even country-level proposals included in Nationally Determined Contributions documents under the Paris Agreement on climate change would increase global poverty by an estimated 4.5 percent if implemented as described (Campagnolo and Davide, 2019).

¹⁷ Lorenza Campagnolo and Marinella Davide, “Can the Paris deal boost SDGs achievement? An assessment of climate mitigation co-benefits or side-effects on poverty and inequality,” *World Development* 122, (2019): 96-109.

¹⁸ Christopher B. Barrett, , Luc Christiaensen, Megan Sheahan, and Abebe Shimeles, “On the Structural Transformation of Rural Africa,” *Journal of African Economies* 26 ,suppl_1(2017): 111–35; Alain De Janvry and Elisabeth Sadoulet, *Development economics: Theory and practice*, Second Edition (Routledge: 2021).

¹⁹ Alexis Habiaryemye, Glenda Kruss, and Irma Booyens, “Innovation for Inclusive Rural

Transformation: The Role of the State,” *Innovation and Development* 10, no. 2(2020): 155–68; Erik Engel et al., *Towards Inclusive and Sustainable Rural Transformation in Sub-Saharan Africa* (Berlin, 2017); GIZ.FAO., *Leveraging Food Systems for Inclusive Rural Transformation: The State of Food and Agriculture* (Rome: 2017); *Food and Agriculture Organization of the United Nations and IFAD, Rural Development Report 2016: Fostering Inclusive Rural Transformation* (Rome: 2016).

²⁰ Stephane Hallegatte et al., *Shock Waves: Managing the Impacts of Climate Change on Extreme Poverty* (Washington, D.C.: World Bank, 2016).

²¹ Rachel Bezner Kerr et al., “Food, Fibre, and Other Ecosystem Products,” in *Climate Change 2022: Impacts, Adaptation and Vulnerability*, contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, eds., [H.-O. Pörtner et al. (Cambridge University Press, Cambridge, UK and New York, NY, USA, 2022), 713–906.

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²³ FAO, *The State of Food and Agriculture 2019: Moving forward on food loss and waste reduction* (Rome, 2019).

²⁴ Ashkan Afshin et al., “Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017,” *The Lancet* 393, no. 10184 (2019): 1958-1972.

²⁵ Andrea Cattaneo, Andrew Nelson, and Theresa McMenomy, “Global mapping of urban–rural catchment areas reveals unequal access to services,” *Proceedings of the National Academy of Sciences* 118, no.2 (2021).

²⁶ NCD Risk Factor Collaboration (NCD-RisC), “Rising rural body-mass index is the main driver of the global obesity epidemic in adults,” *Nature* 569, (2019): 260–264.

²⁷ Caterina Ruggeri Laderchi et al., *The Economics of the Food System Transformation. Food System Economics. Commission (FSEC), Global Policy Report.*

²⁸ Benjamin Davis, Leslie Lipper, and Paul Winters, “Do Not Transform Food Systems on the Backs of the Rural Poor,” *Food Security* 14, no. 3 (2022): 729–40. Even country-level proposals included in Nationally Determined Contributions documents under the Paris Agreement on climate change would increase global poverty by an estimated 4.5 percent if implemented as described (Campagnolo and Davide, 2019).

²⁹ Lorenza Campagnolo and Marinella Davide, “Can the Paris deal boost SDGs achievement? An assessment of climate mitigation co-benefits or side-effects on poverty and inequality,” *World Development* 122, (2019): 96-109.

³⁰ Tim Searchinger et al., *Creating a sustainable food future: A menu of solutions to feed nearly 10 billion people by 2050, Final report* (World Resources Institute: 2019).

³¹ Another innovation that could reduce emissions from agriculture and improve farmer wellbeing is the use of microbial rather than nitrogen fertilizers.

³² Evaluation of these types of funds finds that those which are more performance-based, more autonomous, and more participatory typically outperform those that are less perfor-

mance-based, less autonomous, and less participatory. David Gartner Homi Kharas, "Scaling Up Impact: Vertical Funds and Innovative Governance," In *Getting To Scale: How To Bring Development Solutions To Millions Of Poor People*, (Project Muse, 2013), 103-137.

³³ Junia Howell and James R. Elliott, "As disaster costs rise, so does inequality," *Socius Sociological Research for Dynamic World* 4, no. 4 (2018).

³⁴ The community forestry program widened the gap between the elites and marginalized groups within participating villages. See Cook, N.J., Grillos, T., Andersson, K.P. 2024. Decentralization and Inequality in Nepal's Community Forest Program. Unpublished working paper.

³⁵ Lauren Persha and Krister Andersson, "Elite capture risk and mitigation in decentralized forest governance regime," *Global Environmental Change*, Chapter 24 (2014): 265-276.

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³⁷ Komal Preet Kaur, Kimberlee Chang, and Krister P. Andersson, "Collective forest land rights facilitate cooperative behavior," *Conservation Letters* 16, no. 4 (2023).

³⁸ Krister P. Andersson et al., "Experimental Evidence on Payments for Forest Commons Conservation," *Nature Sustainability* 1, no.3 (2018):128-135.

³⁹ Nathan J. Cook, Tara Grillos, and Krister P. Andersson, "Gender Quotas Increase Equality and Effectiveness of Climate Policy Interventions," *Nature Climate Change* 9, no. 4 (2019): 330-334.

⁴⁰ Lauren Persha and Krister Andersson, "Elite capture risk and mitigation in decentralized forest governance regime," *Global Environmental Change* 24, (2014): 265-276.

⁴¹ See, e.g., Nate G. McDowell et al., "Pervasive shifts in forest dynamics in a changing world," *Science* 368, no. 6494, (2020).

⁴² David Ellison, et al., "Trees, forests and water: Cool insights for a hot world," *Global environmental change* 43, (2017): 51-61; FAO and UNEP, *The State of the World's Forests 2020: Forests, biodiversity and people* (Rome: 2020).

⁴³ IPBES, "Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. eds. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo,(Bonn, Germany: IPBES secretariat, 2019); Frances Seymour and Nancy L. Harris,"Reducing tropical deforestation," *Science* 365, no. 6455(2019): 756-757.

⁴⁴ "Glasgow leaders' declaration on forests and land use,"UKCOP26, . Accessed April 15, 2024, <https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use/>; "Glasgow Declaration Leaders Dashboard," Forest Declaration Assessment and Systems Change Lab, Accessed April 15, 2024 . <https://dashboard.forestdeclaration.org>.

⁴⁵ Take, for example, SDG 16 on peaceful and inclusive societies with access to justice for all, perhaps the ultimate goal of the UN 2030 Agenda. The economic value and remoteness of forests means that they are often sites of conflict and violence. They can also be places of refuge for marginalized or dissident populations. Many Indigenous Peoples and local communities living in or near forests face encroachment or eviction from their lands and other human rights abuses. More participatory forest governance can help avoid such injustice and examples of successful community forest governance can inspire larger-scale change toward SDG 16. See Philippe Le Billon, *Wars of*

Plunder: Conflicts, Profits and the Politics of Resources. (Oxford University Press: 2013); Marcus Colchester. et al., “Justice in the Forest: Rural Livelihoods and Forest Law Enforcement,” (CIFOR, 2006).

⁴⁶ Daniel C. Miller, Stephanie Mansourian and Christoph Wildburger (eds.), *Forests, trees and the eradication of poverty: potential and limitations. A global assessment report* (Vienna: IUFRO, 2020).

⁴⁷ Castle, S.E. Newton, P., Oldekop, J.O., Baylis, K. and Miller, D.C. 2024. Global forest cover dataset incongruence creates high uncertainties for sustainability science. Working Paper.

⁴⁸ Jamela Jagger et al., “The role of forests and trees in poverty dynamics,” *Forest Policy and Economics* 140, (2022)..

⁴⁹ Daniel C. Miller and Reem Hajjar, “Forests as Pathways to Prosperity: Empirical Insights and Conceptual Advances,” *World Development* 125, (2020) 1.

⁵⁰ Nathalie Seddon, “Harnessing the potential of nature-based solutions for mitigating and adapting to climate change,” *Science* 376, (2022): 1410-1416.

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⁵⁴ Maximilian Kotz, Anders Levermann, and Leonie Wenz, “The economic commitment of climate change,” *Nature* 628, (2024):551–557 ; Hugh Bromley et al., *Biodiversity Finance Factbook. COP28 Edition* (BloombergNEF, November 30, 2023).

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⁵⁶ Neil M. Dawson et al., “The role of Indigenous peoples and local communities in effective and equitable conservation,” *Ecology and Society* 26, no. 3 (2021):19. Recent analysis conducted with the Rights and Resources Initiative found that less than 1 percent of the roughly \$400 million in climate and biodiversity commitments related to forests globally committed since 2021 has been earmarked for Indigenous Peoples and local communities. This imbalance must change for effective, just, and enduring climate solutions.

⁵⁷ Parts of this paper were subsequently adapted for publication in Ida N.S. Djenontin, Anne M. Larson, and Daniel C. Miller, “Trends in Forest Livelihoods Research – Taking stock in 2024,” *Forest Policy and Economics* 169, (2024).

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⁶⁶ Taiwo Adebayo and the Associated Press, “‘Carbon colonialism’ in Africa meets resistance as companies seek to sell carbon credits from conservation projects that often upend local livelihoods—or worse,” *Fortune*, April 7, 2024, <https://fortune.com/2024/04/07/environment-carbon-colonialism-africa/>

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⁶⁸ Johan Oldekop et al., “Reductions in deforestation and poverty from decentralized forest management in Nepal,” *Nature Sustainability* 2, no. 5, (2019): 421-428; Richard Damania, Anupam-Joshi, and Jason Russ, “India’s forests—Stepping stone or millstone for the poor?,” *World Development* 125, (January 2020)1.; Festus O. Amadu and Daniel C. Miller, “The impact of forest product collection and processing on household income in rural Liberia,” *Forest Policy and Economics* 158, (2024).

⁶⁹ Miller, et al. 2020.

⁷⁰ Pamela Jagger et al., 2022.

⁷¹ Reem Hajjar et al., “Levers for alleviating poverty in forests,” *Forest Policy and Economics* 132, (2021).

⁷² Susan Charnley and Melissa R. Poe, “Community Forestry in Theory and Practice: Where Are We Now?,” *Annual Review of Anthropology* 36, no. 1 (2007): 301–336.

⁷³ Reem Hajjar et al., “A global analysis of the social and environmental outcomes of community forests,” *Nature Sustainability* 4, (2021): 216–224.

⁷⁴ Rights and Resources Initiative, *Who Owns the World’s Land? Global State of Indigenous, Afro descendant, and Local Community Land Rights Recognition from 2015–2020* (Washington, DC:RRI, 2023)..

⁷⁵ Francisco Alpizar, and Paul J. Ferraro, “The environmental effects of poverty programs and the poverty effects of environmental programs: The missing RCTs,” *World Development* 127, (2020).

⁷⁶ See, e.g., Seema Jayachandran et al., “Cash for carbon: a randomized trial of payments for ecosystem services to reduce deforestation,” *Science* 357, no. 6348 (2017): 267–73, and articles in: Paul J. Ferraro and ArunAgrawal, “Synthesizing evidence in sustainability science through harmonized experiments: community monitoring in common pool resources,” *Proceedings of the National Academy of Sciences* 118, no. 29 (2021).

⁷⁷ James Fairhead, Melissa Leach, and Ian Scoones, “Green Grabbing: a new appropriation of nature?,” *Journal of Peasant Studies* 39, no.2 (2012): 237-261; Chuan Liao and Arun Agrawal, “Towards a science of ‘land grabbing’,” *Land Use Policy* 137, (2024).

⁷⁸ “Standing firm: The Land and Environmental Defenders on the frontlines of the climate crisis,” Global Witness, <https://www.globalwitness.org/en/campaigns/environmental-activists/standing-firm/>.

⁷⁹ CommFor enables distillation of information on over 1500 variables into a much smaller set of key variables. It performs digital boundary mapping to enable integration with satellite data, and collects baseline information and tracks change over time with respect to modules on forest governance (e.g. ownership and property rights, rules, activities, and participation) and socio-economic attributes (demography, market access, well-being, collective action, and infrastructure and other assets). CommFor also maps inventory to estimate the distribution and abundance of valuable forest products; conducts carbon stock assessment to evaluate sequestration potential; and helps plan management to achieve community objectives. It has been piloted in about a dozen countries and is now being used by communities and researchers in India, among other places. Beyond the poverty-environment RCT described above, FLARE is working with key partners such as the Rights and Resources Initiative, a global coalition of more than 150 rightsholder organizations and their allies dedicated to advancing the land and resource rights of local people, to develop trainings and support the use of CommFor by communities around the world.

⁸⁰ William C. Clark and Alicia G. Harley, “Sustainability Science: Toward a Synthesis,” *Annual Review of Environment and Resources* 45, no. 1 (2020): 331–386.

⁸¹ Sister Helen Alford highlighted this work to me in a discussion following my remarks at the conference. See, for example, Edmond Malinvaud, ed., *Intergenerational solidarity: The proceedings of the eighth Plenary Session of the Pontifical Academy of Social Sciences*, 8-13 April 2002 (Pontifical Academy of Social Sciences, 2002).

⁸² Clark noted that he uses the term in the sense that it was introduced into sustainability debates by Amartya Sen, “The ends and means of sustainability,” in *Journal of Human Development and Capabilities* 14, no.1 6–20.

⁸³ See, e.g., Robert Bullard, *Unequal Protection: Environmental Justice and Communities of Color* (Sierra Club Books, 1996).

⁸⁴ David Schlosberg, “Theorising environmental justice: The expanding sphere of a discourse,” *Environmental Politics* 22, no. 1 (2013): 37-55.

⁸⁵ A.R. Siders, “The administrator’s dilemma: Closing the gap between climate adaptation justice in theory and practice,” *Environmental Science and Policy* 137, (2022): 280-289.

⁸⁶ Erica Bower, Rachel Harrington-Abrams, and Betsy Priem, “Complicating ‘community’ engagement: Reckoning with an elusive concept in climate-related planning relocation,” *Global Environmental Change* 88, (2024).

⁸⁷ J.A.G. Cooper, J. McKenna, “Social justice in coastal erosion management: The temporal and spatial dimensions,” *Geoforum* 39, no. 1 (2008): 294-306.