Climate Change Adaptation in Population, Health, Environment, and Development Programs: Status and Further Directions

Abstract: Population, health, environment, and development (PHED) programs combine voluntary family planning and reproductive health (FP/RH) services with environmental conservation, sustainable livelihood, and other health (non-FP/RH) activities into a single intervention. Traditionally, PHED programs have been designed with a goal of simultaneously improving human health and biodiversity conservation outcomes, often near protected areas. However, as climate change has become a greater global concern, PHED practitioners, donors, and policymakers seek to better understand whether and how these programs bolster adaptive capacity and resilience to climate change impacts. This paper summarizes what is known about PHED programs and their ability to foster adaptive capacity and resilience, drawing three primary conclusions. First, many mechanisms in PHED programs linking human health and livelihoods with biodiversity conservation are also likely to have climate adaptive capacity benefits. Second, there may be tradeoffs between achieving biodiversity conservation and climate adaptation objectives. Many of the geographies that are considered most vulnerable to the impacts of climate change are not necessarily locations well-suited for PHED programs intended to improve biodiversity conditions. Third, to improve outcomes, the PHED community should strengthen its understanding of and the evidence supporting the mechanisms linking integrated health and environment programming with improved climate adaptation.

Introduction

Population, health, environment, and development (PHED) programs combine voluntary family planning and reproductive health (FP/RH) services with environmental activities. PHED programs also often include components that address other community health and development needs.[1] These interventions are typically designed with health and environmental goals in mind, under the assumption that providing health, livelihoods, and conservation programming together will yield better outcomes as opposed to only conducting activities in a single sector, or as opposed to conducting programming in parallel and not in an integrated fashion (Lopez-Carr & Ervin, 2017). PHED programs are intended as a preferred development approach for communities that may not benefit from other kinds of interventions due to their livelihood and health needs as well as their remoteness and limited infrastructure.

[1] This paper refers to cross-sectoral integrated programming that combines FP/RH services with environmental and livelihoods programming using the term PHED. This reflects an evolution from terms such as Integrated Conservation and Development Programs (ICDPs) which describes an earlier generation of cross-sectoral programs focused on endangered species conservation, as well as Population, Health, and Environment (PHE) and Population, Environment, and Development (PED) which refer more narrowly to activities that include FP/RH and environmental programming. PHED was selected because it is the broadest of the terms, reflecting the range of activities at the intersection of human health, livelihoods, and the environment. However, not all activities used as examples in this manuscript have components addressing the "H" or "D" elements of the term (i.e. lack health activities other than FP/RH or development activities other than those narrowly focused on conservation and the environment). For more information on the evolution of terminology in this sector, please refer to (Kreuger, 2024).

Other sources provide more complete discussions (De Souza, 2014; Pielemeier et al., 2007; Sellers, 2019; Yavinsky et al., 2015), but in brief, PHED programs evolved from earlier generations of conservation interventions that were intended to provide alternative livelihood opportunities for communities that had a high dependence on local natural resources for their livelihoods and where this resource use threatened the integrity of local biodiversity and habitats. Earlier generations of integrated activities, known as Integrated Conservation and Development Programs, focused primarily on habitat conservation and generally were designed with a goal of protecting charismatic megafauna species as opposed to supporting community resilience or adaptation to shocks and stressors (Barrett & Arcese, 1995; Hughes & Flintan, 2001).

However, in recent decades, the attention of the conservation community and many donors and policymakers has increasingly shifted towards climate change, given its rapidly growing magnitude and large and disproportionate impacts on communities in the Global South, including communities in and around protected areas. PHED practitioners and donors have begun to recognize the importance of emphasizing adaptation and resilience when designing new programs. However, reviews of evidence regarding the effectiveness of PHED programs for improving adaptive capacity are inconclusive, because of the relatively recent addition of this area into programming (Yavinsky et al., 2015), and the traditional emphasis of PHED programs on improving biodiversity outcomes as a primary objective as opposed to strengthening climate adaptation (Gómez & Price, 2018).

In recent years, several PHED programs have adopted language in their project materials, or in some cases, explicit design approaches to improve resilience and adaptive capacity to better address shifting donor interests. Moreover, the growing recognition among donors and policymakers about the intersection between human health and the environment, particularly due to the COVID-19 pandemic that likely originated from wildlife, has helped to reignite interest in development approaches that jointly address human health and environmental challenges (including PHED, but also programs using One Health and similar frameworks). Because of these shifts, this paper summarizes what is currently known about PHED and climate adaptation, along with posing key questions and challenges for the community about this relationship.

There are three key messages that I wish to advance in this manuscript. First, PHED programs are, in general, an appropriate tool for facilitating climate change adaptation in settings where such activities are perceived to be an effective approach for improving integrated development outcomes (i.e. where there is a high dependence on local natural resources for livelihoods that is degrading biodiversity and habitat conditions, driven in part by human population growth, and that are characterized by a lack of access to and/or poor quality of voluntary FP/RH services). Many components of PHED activities that have been traditionally advanced to achieve biodiversity conservation objectives are also likely to improve adaptive capacity and resilience.

Second, while there are complementarities between climate adaptation and conservation outcomes, there are also potential tradeoffs that exist. Activities that seek to maximize

biodiversity outcomes do not necessarily maximize resilience (and vice versa). Additionally, the communities most in need of interventions to improve adaptive capacity are not always located in geographies where biodiversity is high and there is a direct relationship between local use of natural resources and biodiversity loss.

Third, the PHED community must do a better job of theorizing how activities are likely to contribute to adaptive capacity and resilience and monitor progress accordingly. There are several challenges that the PHED community faces in this regard that need to be addressed for programs to effectively demonstrate that they effectively strengthen adaptive capacity and resilience.

This paper has five sections. It begins with 1) a brief discussion of adaptive capacity and resilience and the challenges in measuring these qualities, including in PHED activities. This is followed by discussions of 2) some of the primary mechanisms theorized to link PHED interventions with adaptive capacity and resilience benefits and 3) the relationship between biodiversity and climate adaptation benefits, including the potential for win-win outcomes and tradeoffs in achieving these goals. I then provide 4) a framing of the challenge of understanding climate adaptation and resilience benefits from PHED programs, including some questions and suggested next steps for the wider PHED community and 5) a short conclusion.

Measuring Adaptive Capacity and Resilience

There is a variety of literature that summarizes climate adaptation and resilience among communities in low- and middle-income countries (Ferro-Azcona et al., 2019; Lemos et al., 2013). This paper does not seek to review this literature, but rather to link it to the growing discourse on PHED. The IPCC defines adaptive capacity as "the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences." Resilience is defined in part as "the capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure" (IPCC, 2022). For PHED programming to help promote adaptive capacity and resilience, integrated health, livelihood, and conservation activities should enable communities to better prepare for and respond to the impacts of climate change to maintain and improve livelihood conditions. Improvements in adaptive capacity and resilience must be weighed against potential changes in biodiversity conditions. For example, the development of new natural resource-based industries or tourism activities as a livelihood diversification strategy to help address loss of income due to climate-related impacts risks worsening biodiversity conditions if not properly managed and regulated.

In addition to literature that summarizes the need for, and methods of, adapting to climate change and promoting community resilience, there is also a growing literature seeking to better understand how to measure and monitor changes in adaptive capacity. Development projects,

such as PHED programs, may seek to improve community resilience to climate change, but the duration of such activities is time-bound. Yet the need for strengthened adaptive capacity exists into the indefinite future given the ongoing nature of climate change. Moreover, various sources of heterogeneity, including in community demographic and livelihood characteristics, climate threats, and temporal windows all affect vulnerability and adaptive capacity, making it difficult to distill the measurement of adaptive capacity to a small number of pathways or indicators that can be compared across or within PHED activities. The number of indicators and definitions for understanding adaptive capacity (and by extension, resilience) has grown dramatically in recent years, but this creates difficulty in crafting a common understanding of how to define and measure these terms, even within a relatively small community like PHED practitioners (Engle, 2011; Siders, 2019).

There is a risk that PHED programs emphasize output-based indicators due to cost and simplicity factors. The use of such indicators may facilitate greater comparability across sites within a program or between different programs while providing little information which can be used to understand the mechanisms through which adaptive capacity is improved. For instance, to facilitate ease of reporting and comparability across a vast array of projects supporting climate adaptation objectives, the U.S. government adopted a small number of standard, mostly output-based indicators, such as number of people trained in climate adaptation or number of people supported to adapt to the impacts of climate change. (The future use of these indicators is in doubt due to the recent dissolution of most U.S. government-funded international climate programming) (USAID, 2024).

While this approach can be justified for large organizations with varied portfolios and stringent reporting requirements, the PHED community should emphasize a different approach, seeking to identify indicators at a variety of stages of the activity (input, output, outcome, and impact) that are relevant and specific to the local context in which the program is working in. This should mean that what is measured across programs varies to account for differences in community demographic characteristics, livelihood strategies, and climate hazards. Evaluation methods that seek to understand *why* a particular approach was effective at strengthening adaptation (in addition to other health, conservation, or livelihood benefits), as opposed to simply assessing *whether* a program was effective at achieving certain outcomes or impacts are necessary to understand the contextual factors that strengthen adaptive capacity and resilience. Such methods also help practitioners assess whether these improvements are likely to be sustained beyond the life of the activity (Sellers, 2019).

PHED and Climate Adaptation Mechanisms

Practitioners have theorized a variety of mechanisms through which integrated PHED programming improves both health and conservation outcomes. Some of these pathways also strengthen adaptive capacity and resilience. Below, I highlight five common mechanisms in

PHED activities and describe how they have the potential to generate greater adaptive capacity and resilience outcomes.

Increased income: Many PHED activities promote alternative livelihood strategies that are intended to increase household incomes, such as adopting new crops, beekeeping, soap or crafts manufacturing, or other small-scale home- or community-based businesses. Increased income can enable households to access health care services that were previously out of reach because they were too costly. Additionally, having additional sources of income can enable households to purchase food or fuelwood, potentially reducing pressure on local wildlife and habitats for sustenance. Compared to single-sector interventions, PHED programs are likely to increase household incomes, as illustrated from quasi-experimental evidence from the Philippines (D'Agnes et al., 2010).

Increased income can also promote adaptive capacity to the impacts of climate change. Higher incomes can enable households to pay for schooling. Improvements in human capital are strongly associated with several dimensions of resilience; higher levels of education enable individuals to have more job opportunities, earn more income, and respond appropriately to changes in their local environment (Lutz et al., 2014). Higher incomes can also be used to help pay for health services (discussed below under *Improved health outcomes*). Additionally, higher incomes can facilitate mobility if households need to move temporarily or permanently to avoid climate-related hazards. Migration scholars have noted that it is not necessarily the poorest households that will move due to the impacts of climate change. Households that are relatively well off (though still poor by global standards), may have the means to move whereas poorer households run the risk of becoming trapped in place (Black & Collyer, 2014). Thus, more money can facilitate mobility, which can be life saving for populations in geographies buffeted by climate impacts.

Diversified income: In addition to higher levels of income, PHED activities are also intended to diversify household livelihood strategies for cash or non-cash sources of income (De Souza, 2014). Traditionally, this has been theorized to reduce household dependence on local natural resources, particularly when this dependence is associated with harvesting and use practices that adversely impact local biodiversity and natural resource conditions. Thus, creating more diversified livelihood strategies, where households rely on multiple activities to harvest resources directly for household consumption and for sale can lessen risks associated with dependence on any single activity and can lower pressure on local biodiversity. At the same time, such measures can also reduce livelihood risks associated with relying on a single livelihood activity or resource for household sustenance, which increases the risks that households will be adversely impacted by climate-related shocks and stressors (Antwi-Agyei et al., 2014). While PHED activities have a mixed track record of successfully diversifying livelihood sources (Hahn et al., 2011; Hess et al., 2017; Lopez-Carr et al., 2018), reducing reliance on natural resources that are vulnerable to the impacts of drought or other extreme weather events is likely to improve resilience to increasingly unpredictable conditions. However, as noted earlier, such diversification may come with

tradeoffs if not well-managed. Failure to monitor and manage new activities may lead to higher incomes for local people, but also unintended adverse consequences for biodiversity.

Behavior and attitudinal change: PHED programs generally include an education component designed to raise community awareness of the linkages between human health and the environment, and in particular the environmental challenges that result from overharvesting and poor management of local natural resources. Targeted trainings have helped to increase women's involvement in local natural resource management activities (often traditionally dominated by men), and men's engagement in decisions around FP/RH use (traditionally done by women) (Gaffikin & Aibe, 2018).

However, behavior change because of PHED activities also has the potential to improve climate adaptive capacity. PHED activities often use a "model household" approach, whereby a subset of households in an intervention community are selected and trained in various health, conservation, and livelihoods practices by the implementing organization. These households are then expected to both model behaviors and practices to other community members and in some cases proactively conduct outreach to help neighbors better understand the interventions being offered. The effectiveness of the model household approach in increasing behaviors and practices that are likely to have livelihood as well as climate adaptive benefits, such as tree planting, climate-smart agricultural practices (use of drought-resistant crops), proper handwashing, and school attendance has been demonstrated empirically in evaluations of PHED activities in East Africa (Hess et al., 2017; Lopez-Carr et al., 2018).

Hardee et al. (2018) conduct an in-depth exploration of the dimensions of resilience using data from the Tuungane PHED program in Tanzania. Using structural equation modeling methods to define a series of latent dimensions of resilience and model their relationship to FP/RH use, they find that social participation and trust, as measured by participation and confidence in local natural resource management and government institutions, are strongly associated with their resilience construct. Additionally, a separate latent dimension is developed in their model for attitudes towards natural resource management, which are shaped by project interventions. Greater support for protecting local natural resources is also associated with increased resilience.

Increases in FP/RH use: Some scholars argue that increased adoption of voluntary FP/RH services facilitates adaptation to climate change by giving couples greater control over their fertility goals and space pregnancies given an increasingly uncertain future (Hardee et al., 2018; Rovin et al., 2013; Starbird et al., 2016). There is a growing body of empirical evidence that couples change (and often lower) their fertility desires and births and also change (and often increase) their family planning use in response to climate shocks and stressors (Eissler et al., 2019; Sellers & Gray, 2019; Thiede et al., 2022). There is strong empirical evidence that PHED programs increase FP/RH use and reduce fertility (Gaffikin & Aibe, 2018; Lopez-Carr et al., 2018; Robson et al., 2017).

However, because PHED programs are generally predicated on a hypothesis that reduced rates of human population growth as a result of greater FP/RH use can improve biodiversity and natural resource conditions, they have come under criticism from activists and scholars who are skeptical of the evidence and assumptions underpinning this hypothesis (Senderowicz & Valley, 2023). For instance, in recent years, the SRHR and Climate Justice Coalition has grown as an umbrella organization for activists and other parties engaged on issues related to climate change and sexual and reproductive health and rights.[2] While the SRHR and Climate Justice Coalition notes on its website that "SRHR must be considered as a key component of climate adaptation and resilience action and of climate justice" it also produces a messaging guide that is highly critical of what it calls the "population narrative" that links human population growth and environmental degradation, arguing that this narrative disempowers women and girls and erodes their rights to decide whether and when to have children (SRHR and Climate Justice Coalition, 2023). This situation presents a challenge for the PHED community, where some allies that otherwise agree regarding the benefits of voluntary FP/RH services (among other SRHR components) for fostering adaptive capacity and resilience simultaneously seek to undercut a central assumption in PHED programming around the impacts of human population growth on environmental conditions.

PHED practitioners may be able to make common cause with gender justice advocates to advance discussions of and investments in voluntary FP/RH at negotiations regarding climate finance and technical assistance in international forums and among the donor community. However, it may be harder to develop consensus between these groups on the appropriateness of PHED programming as a climate adaptation strategy. This split within the broader FP/RH advocacy community is unlikely to resolve itself soon. It reflects two different interpretations of both the empirical evidence supporting the hypothesis linking human population growth with biodiversity loss, but arguably as importantly diverging beliefs about the helpfulness in advancing such a hypothesis in order to address goals related to gender equality and climate adaptation. Even if the relationship between human population growth and biodiversity loss has strong evidence to support it, this is not perceived as material by some gender justice advocates because the use of such evidence, regardless of its quality, to advance advocacy on expanding voluntary FP/RH services inherently instrumentalizes women and their bodies and detracts from addressing the root causes of climate change.

Improved health outcomes: Many PHED programs seek to improve access to health services beyond voluntary FP/RH, recognizing that improving well-being and livelihood conditions depends on better community health. Poverty can result in community members engaging in

[2] SRHR refers to sexual and reproductive health and rights, defined as "state of physical, emotional, mental, and social wellbeing in relation to all aspects of sexuality and reproduction, not merely the absence of disease, dysfunction, or infirmity" (Starrs et al., 2018). Efforts to advance SRHR include promoting and ensuring access to FP/RH services, but also emphasize a variety of other interventions intended to advance reproductive rights and well-being, particularly for women and girls, including eliminating early, child, and forced marriage, addressing the root causes of gender-based violence, and providing education and infrastructure to improve menstrual hygiene.

unsustainable activities to earn income to pay for medical care. Quasi-experimental evidence from an integrated health and conservation project in Indonesia shows that increasing access to health care services and allowing for payment using methods other than cash (such as tree seedlings) can improve biodiversity conservation and climate mitigation outcomes (Jones et al., 2020).

Blue Ventures, a leading PHED implementer, has utilized a team of community health workers to provide a variety of health services in remote parts of Madagascar, which are highly integrated with the program's conservation and livelihood activities. This design has not only improved community health outcomes, but it has also strengthened resilience to shocks and stressors. Blue Ventures has documented the resilience of its project communities to both climate- and non-climate related shocks, in part because of its integrated and flexible program structure, including for health services.

In 2013, cyclone Haruna struck southwest Madagascar, causing extensive damage to properties and livelihood activities throughout the region. Project staff cite the strengthened trust in local institutions, including health workers as a result of the project's efforts, as well as the strong commitment of local community health workers (CHWs) to providing outreach and services in the aftermath of the disaster, ensuring that FP/RH, water treatment, and malaria prevention activities continued (Mohan et al., 2020). Moreover, the strong relationship between CHWs and the community, as well as their awareness of and familiarity with local livelihood activities helped communities adapt to the challenges associated with the COVID-19 pandemic. Blue Ventures was able to redeploy staff working on conservation activities to help rapidly scale up its health response in the immediate aftermath of COVID-19, ensuring that supplies and key messages could be delivered to community members in a timely fashion. Conservation staff from the project were able to help craft public health guidance disseminated to local community members that ensured fishing activities (a key livelihood source for many community members) could continue while facilitating social distancing and other COVID-19 safety protocols (Leeney et al., 2022).

Co-Benefits and Tradeoffs between Biodiversity and Climate Objectives

As noted earlier, PHED programs are typically implemented in geographies in or near protected areas or other sensitive ecosystems where human activity is adversely affecting local biodiversity and habitat conditions. These are generally remote locations, where getting to/from a major city can take many hours or even days. Moreover, communities where PHED programs are conducted are characterized by substantial poverty and livelihood challenges, where there are few income-generating opportunities and the opportunities which exist are not particularly remunerative.

While PHED interventions are primarily focused on addressing the root causes of human behaviors that adversely impact ecosystem conditions, there is also a growing body of evidence

noting the ways in which the impacts of climate change are likely to adversely impact these ecosystems, in some cases at scales that dwarf the impacts from human activity (Muluneh, 2021; Trew & Maclean, 2021). Particularly problematic is that highly biodiverse geographies typically provide important ecosystem goods and services to human populations, such as local foods and clean water, and the capacity of natural systems to provide these services to humans is greatly impaired by the impacts of climate change. Communities where PHED programs are sited thus face a double burden, not only lacking viable livelihood opportunities due to their remoteness and poverty but also encountering growing threats to their well-being due to the impacts of climate change on the natural systems upon which they heavily depend. This arguably provides an even greater impetus for conducting PHED activities than would otherwise exist because the magnitude of the threats faced by natural systems has grown in recent decades (to include climate change as well as human activities), and the consequences of the failure of natural systems on human well-being are better understood than ever before.

However, this is not the only way of understanding how best to achieve biodiversity and climate change goals. In 2023, the Population Institute released a report exploring population indicators and climate change vulnerability, using data from the ND-GAIN Index that measures vulnerability and adaptive capacity (Arias et al., 2023). It finds that there is a close correlation at the national level between poor reproductive and maternal health outcomes, such as high fertility and maternal mortality rates and low gender equality scores and high vulnerability and low adaptive capacity to climate change.

Conservation International has identified 36 biodiversity hotspots around the world—terrestrial regions that have exceptional conservation value and which play an outsized role in providing ecosystem goods and services, but which are under threat from human activity (Critical Ecosystem Partnership Fund, 2024). Many of the countries that are considered the most vulnerable through the Population Institute analysis, and which are arguably in greatest need of interventions to strengthen climate adaptive capacity and FP/RH outcomes are countries do not contain biodiversity hotspots and have lacked significant PHED programming in part for that reason. Such countries include Niger, Chad, Sudan, and the Central African Republic.

PHED practitioners utilize evidence about biodiversity conservation needs when siting new activities. For instance, Margaret Pyke Trust recently identified highly biodiverse sites in Mozambique and Zambia as potential locations for new activities, though the organization also notes the significant vulnerability to climate change that communities in these regions face as part of the justification for selecting these locations (Margaret Pyke Trust, 2023). That said, the communities facing the greatest vulnerability to the impacts of climate change as measured by commonly used indicators of vulnerability, such as household income, educational attainment, and health status, and the communities adjacent to ecosystems that are facing threats from local human activity that can be addressed through PHED programs are unlikely to be the same.

While the previous section highlighted much of the evidence demonstrating the impact of PHED programs, these activities can be expensive to implement, particularly on a per capita basis. Though realized costs vary considerably across projects based on services provided, geography, and staffing, even a small program can cost millions of dollars over the course of several years. While some savings may be realized by combining the administration of services across sectors (Mohan & Shellard, 2014), there are also added complexities from programming in multiple sectors. Moreover, because PHED programs are typically located in very remote settings, and often in communities with relatively small (albeit rapidly growing) populations, the cost per person served can be higher than for some other kinds of development interventions. Additionally, the remoteness of these communities can limit the types of interventions (such as the number of FP/RH methods provided) that can be provided cost-effectively (Lopez-Carr et al., 2018).

Two caveats are worth mentioning. First, analyses at the country level, such as the analysis by the Population Institute, while valuable, are also limited in terms of their ability to inform the PHED community, because PHED projects are designed around specific social and environmental contexts and there can be significant variation within countries in terms of livelihood conditions, vulnerability to the impacts of climate change, and the appropriateness of PHED as a development approach. Unfortunately, many analyses of vulnerability and adaptive capacity rely on data generated at spatial scales (national or regional level) that are above the spatial scale that PHED programs are planned at. This can make it challenging to clearly understand the degree of vulnerability within possible program geographies and how to appropriately prioritize. Second, the communities that organizations like Margaret Pyke Trust intend to program in are extremely poor by global standards and highly vulnerable to the impacts of climate change. Even if these communities may not be, strictly speaking, the *most* vulnerable, they nonetheless require substantial assistance to improve adaptive capacity and resilience.

This suggests that if a donor is solely focused on maximizing the impact of their funds on adaptive capacity and resilience, PHED programs may not be the best place to invest. This is not only because PHED programs can be costly per person, but also because they are in settings which are not necessarily those that have the greatest needs as measured by vulnerability and adaptive capacity indicators. However, the imperative to invest in stronger and more resilient livelihoods in many communities that would benefit from PHED programs is substantial, and PHED has the potential to offer significant win-win solutions that advance both biodiversity and adaptive capacity outcomes. But such synergies are highly context-dependent, and PHED practitioners should strive to identify locations where both significant biodiversity and adaptive capacity benefits can be realized with modest investments.

Further Directions

Despite not traditionally having an explicit focus on strengthening climate adaptive capacity and community resilience, the types of interventions bundled together in PHED programs are quite

likely to realize these objectives. In many cases, adaptive capacity and resilience objectives can be realized without harming the achievement of other project goals around biodiversity, livelihoods, and health.

However, stronger evidence is needed to substantiate these claims. As noted earlier, measuring the impacts of development programs on climate adaptation and resilience is challenging and a variety of approaches have been developed. The most comprehensive study of how a PHED activity contributes to resilience, Hardee et al. (2018), mixes output and outcome-based measures to develop latent constructs. While this study is an important advance in the field, it tells us little about longer term advances in adaptive capacity due to data limitations. And it also leaves questions unanswered about the mechanisms through which resilience is enhanced in remote communities because of a PHED program. How did the *integration* of programming across health, livelihoods, and the environment enable improvements in resilience in a way that other approaches may not have? This gap suggests a greater need for experimental and quasi-experimental methods in PHED research, but also to mixed methods approaches that seek to elucidate stakeholders' own theories of change for why a particular activity resulted in changes to community resilience.

Moreover, such work should more robustly explore the heterogeneity of outcomes and impacts across different members of the community. PHED programs often seek to provide benefits for community groups that are often marginalized, including women, young people, and persons with disabilities. Increasing a community's aggregate resilience or adaptive capacity while simultaneously increasing the gaps within a community between individuals that have more and those that have less adaptive capacity is arguably a development failure, and one that PHED practitioners should be able to identify and address if this is occurring.

The growing focus on climate adaptation and resilience in development discourse also points to possible opportunities and challenges for the PHED community to expand the reach of its programming to new geographies and settings but also to change how PHED activities are delivered. Three directions for doing so are briefly explored below.

New geographies: While informal conversations among PHED practitioners have sometimes explored the idea of "urban PHED" programs targeted in urban or peri-urban settings, no such programs have been scaled to date. Many PHED programs include support for higher yielding and/or more climate-resilient crops as well as for the development of small home gardens or orchards that can increase household food supplies. Such activities may be well suited to urban settings where the livelihoods challenges faced by communities differ from those in rural areas. Informal settlements or other newer developments in urban areas may have limited access to public services and benefit greatly from programs focused on gardening and small-scale agriculture, as well as improved health service provision. Moreover, many informal settlements are located in parts of cities that are most vulnerable to the impacts of climate change, such as in low-lying flood prone areas (Ajibade et al., 2013).

Programs that seek to use natural climate solutions by restoring natural habitats to help reduce flooding and other risks associated with extreme weather events may be well suited for PHED, and such investments are also likely to have benefits to biodiversity outcomes. However, for donors focused on maximizing biodiversity outcomes, a focus on urban PHED challenges may not address their needs as cities tend not to coincide with biodiversity hotspots. Considering rural geographies near coastal regions or rivers that provide habitats for a variety of endangered species while also being vulnerable to the impacts of climate change may be another direction for the community to take when considering new program sites.

It is also important to note that the growth of informal settlements is often largely fueled by in-migration and not natural increase, and that local livelihoods are less reliant on local natural resources than in remote communities where PHED programs have traditionally been conducted. This does not make increasing voluntary FP/RH service provision moot in urban settings, but it does change the argument underpinning as to why packaging these services alongside other development interventions will lead to synergistic development benefits, something that the PHED community will need to more strongly theorize before developing such programs.

Role of voluntary FP/RH services in PHED: PHED programs are predicated on a link between human population growth and environmental degradation, which can be ameliorated through providing voluntary FP/RH services. However, fertility rates globally are falling, though still are high in many of the communities with active PHED programs. Additionally, while gaps remain, particularly in parts of sub-Saharan Africa, access to voluntary FP/RH services has improved globally in recent decades (FP2030, 2023). And as noted earlier, the link between human population growth and environmental degradation is challenged by gender advocates who view such arguments as being harmful to achieving goals related to gender equality and climate adaptive capacity. This raises fundamental questions about the appropriateness or desirability of PHED programming. The integration of voluntary FP/RH services with conservation activities is central to what distinguishes PHED from other development frameworks, such as One Health. Thus, practitioners that seek to expand the use of PHED as the focus of the policymaker and donor communities increasingly shifts to climate adaptation should also recognize its limits and strengths as a development approach. Given the challenges faced by communities adjacent to protected areas that struggle with livelihoods and the impacts of climate change, there is arguably a stronger case than ever before for PHED, but in a limited number of settings.

Expanding PHED programs to urban settings requires the model to be reimagined in substantial ways, where voluntary FP/RH service provision is intended to facilitate climate adaptation directly, and not because there is a robust link between human population growth from natural increase and the resulting deterioration of local natural resources. An effort to reimagine the rationale for PHED would also benefit from greater evidence into the climate adaptive benefits of voluntary FP/RH services. Providing choice to women and couples in the face of uncertain livelihoods may facilitate climate adaptation, but this link is less direct than some other interventions focused on implementing new crops or strengthening physical infrastructure to

resist the impacts of extreme weather events. Thus, in the marketplace of projects competing for limited climate adaptation dollars, programs emphasizing FP/RH may not be particularly competitive without more compelling evidence and rationales linking voluntary FP/RH service provision to improvements in adaptive capacity and resilience.

PHED as a climate & health intervention: In recent years, the academic literature and public awareness of risks associated with climate change and human health has grown dramatically. *The Lancet* has described climate change as "the greatest global health threat facing the world in the 21st century" (Romanello et al., 2023). There may be ways to more explicitly tie in climate adaptation benefits with how health services are provided within PHED programs that relate less to the underlying goals of the service for well-being and more on ensuring service continuity and quality during and after extreme weather events. This includes efforts to strengthen physical infrastructure and expand the use of renewable energy in health facilities, working with health systems to preposition supplies in communities prior to an extreme weather event that may damage roads and other critical infrastructure or to respond to climate-driven seasonal changes in disease prevalence, and training staff and community members in responding to health impacts associated with climate change.

Ensuring that climate adaptation considerations are thoroughly integrated throughout the design and implementation of health activities that are part of PHED programs not only will help better enable PHED programs to achieve their objectives, but may also help strengthen the case for PHED among policymakers and donors as an attractive development investment to address issues of climate adaptation and resilience. Achieving this, however, requires developing a thorough understanding of the health risks within local communities associated with climate change as well as the challenges health systems face in responding to those risks and making operational investments to improve service delivery.

Conclusion

PHED programs play a vital role in addressing local health, livelihood, and conservation needs in rural communities. There is a growing evidence base to suggest that these programs also have benefits for climate adaptive capacity and resilience, even though PHED programs have traditionally not been designed with those objectives at the forefront. In many contexts, PHED presents a win-win solution for both biodiversity and the climate. However, while many PHED practitioners are thinking about the climate adaptive benefits of their programs, even more can be done to accelerate these benefits, including through changes in the siting of activities and the mix of activities programmed.

Explicitly designing PHED programs with climate adaptation and resilience in mind presents two sets of tensions. The first is with biodiversity donors and practitioners that seek to maximize conservation benefits from PHED programs, when conservation aims must be weighed against adaptive capacity benefits. Programs which seek to maximize one may be unable to fully realize

gains in the other. The second is with donors and advocates in the SRHR community that seek to increase funding and attention to voluntary FP/RH and other services to strengthen women's adaptive capacity to climate change, but who are critical of the link made in PHED programs between human population growth and environmental degradation. Framing PHED specifically as a climate adaptation solution as opposed to one centered on biodiversity conservation may exacerbate these tensions between groups that are otherwise in strong agreement on the importance of promoting voluntary FP/RH services, albeit for different reasons.

Finally, PHED practitioners must do more to strengthen the evidence linking the five mechanisms described above as well as other possible mechanisms that connect human health and livelihoods interventions with climate adaptive capacity and resilience benefits. Without a stronger understanding of the theoretical linkages between health and livelihoods programming and climate adaptive capacity and resilience outcomes, PHED programs are likely to not achieve their aspirations vis a vis adaptation, particularly when it comes to ensuring that adaptation capacity improves across the community and ensuring that the gains are likely to be maintained beyond the life of the project.

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