



Resilience, equity and growth in semi-arid economies: a research agenda

Working paper



PRISE

Pathways to resilience in semi-arid economies



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Research for climate-resilient futures

Resilience, equity and growth in semi-arid economies: a research agenda

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This working paper has been produced as part of a series of papers to guide the long-term research agenda of the Pathways to Resilience in Semi-arid Economies (PRISE) project. PRISE is a five-year, multi-country research project that generates new knowledge about how economic development in semi-arid regions can be made more equitable and resilient to climate change.

Front cover image:

Succession of Nguni African Cattle.

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Acronyms

CPIA	Country Policy and Institutional Assessment
DFID	Department for International Development
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
IPCC	Intergovernmental Panel on Climate Change
PRISE	Pathways to Resilience in Semi-arid Economies
SAL	Semi-arid Land
SDG	Sustainable Development Goal
SMEs	Small and Medium Enterprises
UN	United Nations
UNDP	UN Development Programme

Abstract

Pathways to Resilience in Semi-arid Economies (PRISE) is a five-year research collaboration conducting research in the drylands of Burkina Faso, Kenya, Pakistan, Senegal, Tajikistan and Tanzania. In this paper, we argue that growth must be fast, fair and resilient in order to reduce poverty and achieve the Sustainable Development Goals in a time of increasing climate risk. We consider what fast, fair and resilient growth means in the context of rapidly changing socioeconomic and environmental systems in drylands. In so doing, we examine five recurring issues: difficult geography, weak institutions, poor access to markets and trade, deficits in infrastructure and human capital and low productivity. Lastly, we introduce PRISE's seven multi-disciplinary research projects, and align them with pathways for policy and investment to support equitable climate-resilient growth.

1. Introduction

The Sustainable Development Goals (SDGs), adopted in September 2015, contain the key goals of ending chronic poverty and stopping climate change. Meeting these goals requires *growth with depth*. In other words, economic growth must not only result in human development. It must also be intrinsically fair, accessible to and with benefits for all, environmentally sustainable and resilient to the shocks and stresses that can be expected from changes in the global climate, an evolving global economy and rapidly growing and urbanising populations.

Climate change and extremes pose growing risks to economic growth, particularly in developing countries. At the same time, patterns of economic growth shape vulnerability and resilience to climate impacts (Castells-Quintana et al., 2015a). However, many businesses and policy-makers are not yet convinced by the need to invest in climate resilience. Too often, the case has been made based on long-term projections of climate change impacts, which present pessimistic visions of a world 50 or 100 years in the future. These projections are complicated for non-specialists to

interpret, and do not provide specific information about climate impacts on the economy and businesses, or how to manage them. Nor do these arguments address the short-term horizons of investors motivated by profits, or of politicians concerned by re-election and more immediate demands from their constituencies. Further, psychologists continually reiterate that scare stories are not a strong motivator of action, particularly when they do not present an immediate personal threat or offer straightforward solutions.

This is why we advocate a different approach through the project Pathways to Resilience in Semi-arid Economies (PRISE). We are unconvinced that starting with assessments of climate change and impact, and working backwards to identify options for adapting business-as-usual activities to new climate conditions, will achieve what is needed (see, e.g., Conway and Schipper, 2011). Instead, we focus on pathways for investment and development that have the potential to unlock rapid economic growth, poverty reduction and climate resilience simultaneously in semi-arid

lands (SALs). Each of our seven research projects considers a promising pathway, such as managing migration or developing new market opportunities, in terms of fast, fair and resilient modes of growth and the interactions between them.

This paper sets out the rationale and aims of PRISE's research, and attempts to situate the challenges of achieving fast, fair and resilient growth in terms of the growth and development economics literature. It sets out our understanding of what fair, fast and resilient growth means, what the trade-offs between these principles may be and how they relate to the current development status in SALs.

PRISE has a large interdisciplinary team, and framing these questions in a way that is meaningful and useful for different types of expertise has been a challenge. This paper is therefore aimed at researchers and practitioners in climate change adaptation and resilience who are interested in broader economic development and poverty reduction contexts of their work.



2. Growth for poverty reduction in a changing climate

Reducing poverty and achieving the SDGs in a time of increasing climate risk means growth must be fast, fair and resilient. But, beyond broad platitudes, what does this mean, and what are the challenges?

2.1 Fast growth

Economic growth is the increase in output (goods and services) produced in an economy, measured at constant prices – that is, adjusted for inflation. The increasing value of goods and services implies improving living standards.

Economic growth is therefore key to poverty reduction. In this paper, we talk about ‘fast growth’ rather than simply ‘growth’ because we regard reducing poverty as quickly as possible as an intrinsic good, and also because – if per capita gross domestic product (GDP) is to increase – economies need to grow faster than populations.

The literature has moved forward from the Washington Consensus of the 1990s, which largely stressed the advantages of leaving markets to their own devices (Williamson, 1990). Most growth experts now place more emphasis on the role of public policy and strong institutions in ensuring macroeconomic stability, encouraging innovation, protecting investors and opening up to regional and global markets (see, e.g., Acemoglu et al., 2001; Rodrik et al., 2004; Winters, 2004; Hausmann, 2006).

It is not just about economic stability, institutions and trade, however.

Growth and development experts also point to difficult geography, low firm productivity and weaknesses in factor endowments – the assets such as natural resources, human capital and physical infrastructure that are available for adding value to production – as constraints to economic growth in developing countries (Sachs, 2003; Hausmann et al., 2005; Collier, 2006; Grey and Sadoff, 2007; DFID, 2009; Bowen et al., 2012; Castells-Quintana et al., 2015a, 2015b).

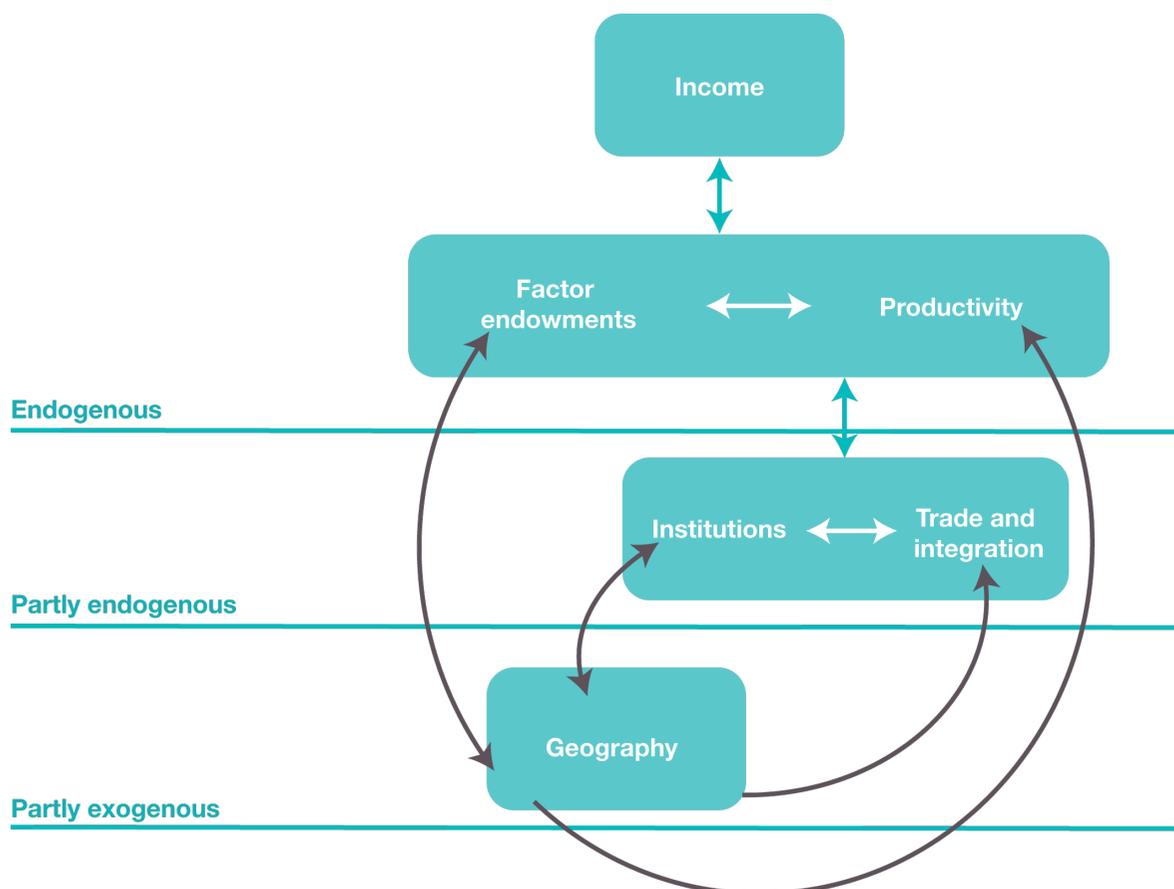
Despite general recognition of the different factors involved, experts disagree over their relative importance and the relationships between them. Some argue that geography is a strong determinant of institutions; for example, the allocation of surface irrigation waters in semi-arid and arid areas requires institutional arrangements that are qualitatively different to those found in rain-fed agricultural areas and lead to different social and political dynamics (e.g. Coward Jr, 1980; Tsusaka et al., 2015). Similarly, competition to control valuable rents from natural resources such as oil, metals and diamonds can weaken institutions and governance and lead to vicious cycles that undermine other factors for economic development. Geography therefore shapes the primary functions of institutions, how they evolve and

also how strong or weak they may be (see Castells-Quintana et al., 2015a for a review). There are also counter-examples, where strong institutions and infrastructure investments have overcome the limitations of geography (Rodrik, 2003). California’s west coast is such an example, where large-scale water transfers from the Colorado River allowed irrigation and the growth of flourishing cities.

A critical question is that of path-dependency. Prescriptions for unlocking fast growth will be contingent on initial conditions such as historical legacies, climate, economic specialisms, institutions, political systems and other factors. Contextualised evidence and nuance are needed in judging which investments and policy measures are most likely to generate positive outcomes leading to further positive outcomes, turning vicious into virtuous cycles of growth and development.

Figure 1 summarises this discussion. It shows institutions and trade as determinants of factor endowments and productivity, and geography as a deep determinant of the other four growth factors. We have adapted it from Rodrik (2003) by incorporating the influence that institutions and factor endowments can have over geography.

Figure 1: 'All of growth economics on one page'



Source: Adapted from Rodrik (2003).

2.2 Fair growth

There is broad consensus that economic growth is necessary for poverty reduction. Development economists search for equitable growth strategies that raise household incomes, offer economic opportunities to all members of society and do not harm economic performance (Rodríguez-Pose and Wilkie, 2015). Common prescriptions are high labour intensity and increasing formality, diversifying the economy and employment away from agriculture, as well as capturing the potential benefits of migration and urbanisation (see, e.g., Dercon, 2012). For many experts, the benefits of formalisation are particularly attractive, including clearer property rights, higher tax revenues and pathways for improved working conditions and wages.

Yet growth in GDP can disguise rising inequality in household income, and the benefits of growth are not

necessarily shared with poor people or marginalised groups such as women or minorities (Ravallion, 2001; Kabeer and Natali, 2013). Formalisation, capital ownership, rent-seeking and inequality can be mutually reinforcing. Large commercial investments can appropriate land and water, displacing local communities whose livelihoods may depend upon these resources (Cotula, 2009).

Formalisation can also marginalise those who depend on informal markets. The informal livestock sector in Africa, for example, is more labour-intensive than its formal counterpart, and provides meat to poor people whom formal suppliers find unprofitable (Costales et al., 2007). An estimated 43% of African people currently gain at least part of their income and food security from informal international trade (Afrika and Ajumbo, 2012). Formalising cross-border trade could reduce public welfare if it is not handled with awareness of how trade and livelihoods are interconnected.

Fast economic growth can therefore have positive and negative implications for equity. Similarly, inequality can have benefits and costs for growth. Moderate levels of inequality can be beneficial by spurring competition, investment and risk-taking. However, inequality can also retard economic growth; concentrations of land, capital and political power in the hands of elites can stifle competition and innovation, lead to unaccountable and ineffective institutions and fail to invest in the economic potential of disadvantaged groups (Sokoloff and Engerman, 2000; Piketty, 2014).

While economic growth raises net welfare in principle, specific routes to growth and investments can create winners and losers. Table 1 lists some factors for equitable and inclusive growth commonly identified in the literature. Growth pathways may largely determine how poor and marginalised groups share in the costs and benefits of growth, but supportive policies can also mitigate impacts and shape opportunities.

Table 1: Factors of equitable and inclusive growth

Education	Raising human capital and ability to take advantage of opportunities
Employment	Labour-intensive modes of production
Tax policy	Progressive taxation systems, and equitable redistribution of benefits
Strategic investment	Policies affecting development of new economic sectors, and investing in opportunities from migration and urbanisation
Participation	Policies supporting formation of micro- and small enterprises, and opportunities for women and marginalised groups
Formalisation	Barriers to businesses registration, recognition of customary rights and tenure in land and water, policies for labour conditions, sensitivity of formalisation transitions and impacts on livelihoods

Source: Authors.

2.3 Resilient growth

Economies and societies are buffeted by shocks and stresses. Disease epidemics, armed conflict and climate extremes (floods, droughts) displace and kill people, damage assets such as power stations and roads and disrupt businesses and supply chains. These impacts can undermine economic growth, and repeated shocks can keep vulnerable people in chronic poverty (Shepherd et al., 2014).

Economies and societies are typically adapted to common climate

extremes and natural hazards – an example of how geography shapes institutions, infrastructure and other economic factors (Figure 1). Yet climate change is altering some fundamental aspects of geographies, such as the frequency and intensity of climate extremes and the timing and duration of rains. The increasing challenge is to strengthen economic resilience, so growth can continue in the face of adversity.

Although many definitions exist, resilience is essentially the ability to anticipate and/or absorb social, economic and environmental shocks, and adapt to changing risks (Table

2; Bahadur et al., 2015). Anticipation implies forward planning, avoiding investments in hazard-prone areas and reducing vulnerability of activities. Impacts can be absorbed – if they cannot be avoided – by stockpiling assets, obtaining insurance and taking measures to ensure operations and profitability can continue. Adapting to changing risk implies a capacity to invest in innovation and new opportunities, and to exit from activities and locations that are increasingly vulnerable to new climate conditions.

Table 2: Factors of resilience

Anticipate	Reduce exposure to hazards by reducing investment in vulnerable sectors and places
Absorb	Reducing sensitivity to impacts and strengthening ability to continue operations during a climate shock
Adapt	Respond to changing risks through investment and divestment

Source: Adapted from Bahadur et al. (2015).

In some respects, growth is good for resilience. Increased wealth means people and organisations have more capacity to avoid and absorb shocks and adapt to changing risks. However, some prescriptions for fast growth may undermine resilience. Efficiency, for example, is usually viewed as key to raising productivity and growth. Yet, from the resilience perspective, highly efficient systems can be vulnerable to shocks. For example, efficiency-focused businesses that remove stockpiles and improve logistics can lower their operational costs, but can become more vulnerable to supply disruptions. This contrasts with drought-adapted traditional livelihoods, such as dryland agropastoralism, which tend to favour low but surer average returns by maintaining stockpiles and liquid assets, mixing crops and spreading risk.

Conversely, resilience can support long-term growth and sustainability. Resilience implies a forward-looking component that assesses likely climate change, and improves the

ability of businesses and economies to maintain performance despite adverse circumstances and changing risks. Investing in resilience generally increases short-term costs, however, making it harder to achieve profitability and growth. For profit-motivated investors, and politicians focused on short-term electoral success, investments in resilience may not be attractive if initial costs are large, discount rates are high – that is, patience is limited – and the return period on shocks is long or uncertain (Lemma et al., 2015).

Trade-offs between resilience and growth therefore seem likely. The public policy challenge is to encourage both growth and resilience through incentive structures that address time horizons and discount rates without encouraging unsustainable risk-taking by businesses and investors.

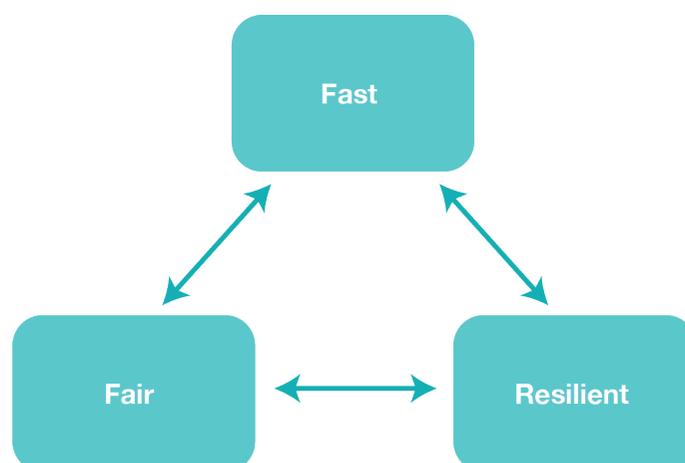
2.4 Fair, fast and resilient?

At a minimum, resilient equitable growth requires that:

- economic systems – that is, the means of producing, exchanging and distributing goods and services – are able to avoid, absorb and adapt to climate impacts
- all in society share the benefits of growth and have access to opportunities and
- resilience and equity concerns do not retard long-term economic growth

Whether fast, fair and resilient growth can be achieved in underdeveloped areas prone to climate extremes is an aspiration that remains untested. Trade-offs between rapid growth, resilience and equity may be more likely than achieving all three outcomes in equal measure. Further challenges may come from initial conditions, as a result of historical legacies, distributions of resources and people, institutional weaknesses, political realities and potential trade-offs with other policy objectives, such as ecosystem conservation.

Figure 2: Components of climate-resilient economic growth



Source: Authors.

3. A focus on semi-arid lands

SALs bring these issues of growth, equity and resilience into sharp relief. Home to a billion people, SALs are hotspots of global poverty, underdevelopment and climate risk (de Souza et al., 2015; Tucker et al., 2015).

3.1 The character of semi-arid lands

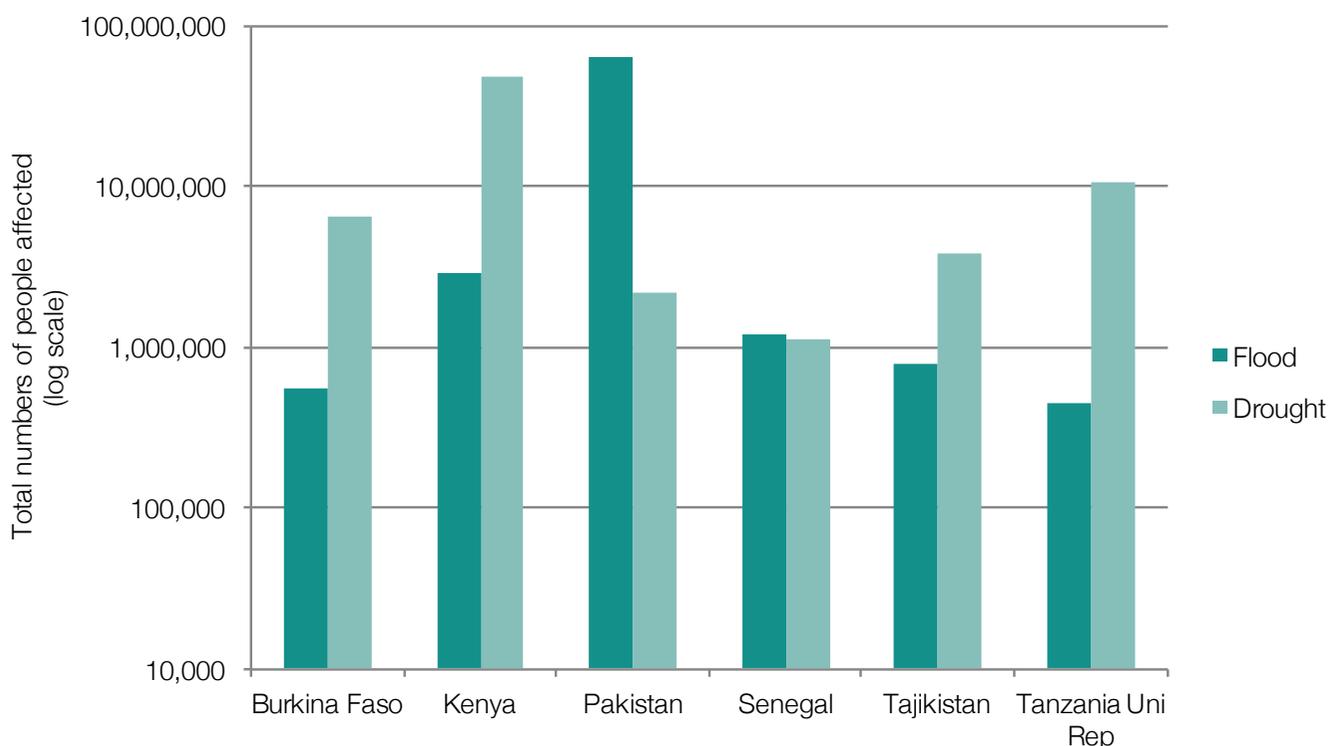
Hot and cold SALs are dry zones with more evaporation than precipitation (Peel et al., 2007). The Sahel region extends across West Africa to the south of the Sahara and is a typical hot SAL, with hot summers and warm winters, low relative humidity and between 100 and 600 mm of precipitation each year. The high-altitude steppes of

Tajikistan are typical cold SALs, with hot summers, cold winters and large temperature differences between day and night. Other key features of SALs are climate variability and extremes, which are likely to increase in coming decades (IPCC, 2014).

Typically, SALs have marked wet and dry seasons, with unpredictable precipitation on daily and annual time scales. During rainy seasons, short, heavy bursts of rain can be interspersed with regular light showers, and some rainy seasons are much drier than others. As a result, both droughts and floods are common hazards in SALs (Wade et al., 2015) (Figure 4).

SALs tend to have low population densities, except near specific geographies such as water sources or in urban areas. The influence of physical geography has shaped distributions of people, markets, infrastructure and services in SALs in ways that persist today. In the past, low population densities and low resource use pressure meant SALs generally recovered from the impacts of severe droughts; however, rising populations mean droughts impacts tend to be more serious for natural resource productivity, including soil degradation and processes of desertification (Stewart et al., 1991; FAO, 2008).

Figure 3: People reportedly affected by flood and drought in PRISE countries, 1990–2014



Note: EmDat, the International Disasters Database, is compiled from various sources, including United Nations and humanitarian agencies, press reports and insurance companies. The lack of standardisation means figures should be treated with caution.

Source: <http://www.emdat.be>

3.2 Barriers to growth

Poverty is not unique to SALs and not all SALs are underdeveloped; California and Australia are both examples of advanced economies where strong institutions and investments have largely overcome deficits of geography. Moreover, income-based poverty indices do not reflect the nuances of poverty in traditional dryland livelihoods, where asset wealth can be more important than income (Hesse and MacGregor, 2006). Furthermore, the common view of drylands as economically unproductive understates a diverse range of economic opportunities, including tourism and extractive industries, capable of diversifying and building on strengths in agriculture and pastoralism and offering new livelihood opportunities in growing urban economies.

On the whole, however, arid and semi-arid drylands do tend to poverty. Dry developing countries tend to have higher than average infant mortality rates and lower average gross national product per capita than other developing countries (UNCCD, 2010). Even within dry countries, drier areas are often poorer; for example the arid interiors of Senegal are poorer than the coast (Batana et al., 2012; Mabhuye et al., 2015).

Why is poverty such a pervasive feature of SALs? Growth diagnostics for semi-arid economies, including PRISE countries, feature recurring issues (see, e.g., Hausmann et al, 2005; Collier, 2006; Bowen et al., 2012), classified using the headings shown in Figure 1:

- **geography:** a fragile natural resource base in terms of water and soil endowments and a highly variable climate (Sachs, 2003; Grey and Sadoff, 2007; Mabhuye et al., 2015; Wade et al., 2015); this is the most widely recognised feature of semi-arid economies, and is a driver for the other factors
- **institutions:** weak regulation, under-capacitated public

institutions, macroeconomic instability, low penetration of financial services and parallel formal and informal institutions (Castells-Quintana et al., 2015a, 2015b; Lemma et al., 2015)

- **trade and integration:** remoteness and poor access to markets (Castells-Quintana et al., 2015a; Lemma et al., 2015)
- **factor endowments:** shortcomings in terms of physical infrastructure (e.g. roads) and human capital (Castells-Quintana et al., 2015a; Lemma et al., 2015; Qaisrani, 2015)
- **productivity:** uncompetitive markets, under-performing firms and poor access to finance (Lemma et al., 2015)

These factors are not exclusive to drylands, but, in combination and on their own, they hold back economic growth in SALs. Growing risks from climate change are likely to exacerbate the effect of these challenges (Wade et al., 2015). Historic and current patterns of development (e.g. colonisation, inward investment) also affect equity and equality of opportunity. While these challenges are not unique to SALs, a key interest here is how their character is affected by the particular geography of SALs.

Physical geography

In SALs, water is scarce and variable, and soils are vulnerable to degradation and erosion. For those with agricultural and pastoralist livelihoods, natural resource degradation can be a driver of out-migration (Djiga, 2009; Mabhuye et al., 2015). Water scarcity, supply disruptions and the impacts of droughts and floods drive up business costs and reduce productivity, not least in agriculture (Lemma et al., 2015).

In rainfed areas, traditional crops and vegetation in SALs tend to be low-productivity, drought-tolerant varieties (Mabhuye et al., 2015). Traditional livelihoods often spread risk through mixing crops, or by

moving livestock over wide rangelands. Pastoralism in East Africa is an extensive industry, with international trade dimensions (albeit mostly uncharted and in the informal sector) (Hesse and MacGregor, 2006). In extensively irrigated areas, such as Pakistan's Punjab, productivity is much higher – yet the whole system depends on the timing, capture and distribution of distant rainfall.

Attempts to raise agricultural productivity in SALs often meet with varied success and negative externalities. For example, development of large commercial farms has disrupted pastoralist migration routes and land access in Kenya and Tanzania (Galaty, 2013). Higher farm yields also imply higher agricultural water demand, although the direct effects of increased CO₂ concentrations on crop water productivity may lead to reductions in crop water use in some SALs (Deryng et al., 2016). Development pathways requiring greater consumption of water in agriculture in water-stressed areas have important opportunity costs, reducing the water available for other sectors and for diversifying economies as well as exacerbating drought sensitivity (Molden, 2007).

Some SALs also contain abundant mineral and non-renewable natural resources: energy exploration and exploitation in regions such as Balochistan (Pakistan) and Turkana (Kenya) are key economic drivers (Lemma et al., 2015). Yet, as previously remote areas become accessible, heavy investment and development in the resource sector is likely to affect other sectors (an effect known as Dutch disease), and can exclude or have negative impacts on poor people.

A central question for semi-arid economies is how to sustainably and equitably overcome geography through investments in factor endowments or the development of sectors with comparative advantage in SALs. Dams, for example, are a common prescription for mobilising

water supply, smoothing seasonal and inter-annual variability in water supply and mitigating drought risk; yet dams can have large social impacts, and climate change impacts on sedimentation loads may affect their useful lifespan (Walling and Fang, 2003). Not all investments in commercial agriculture may be well suited to environmental constraints, yet opportunities for developing livestock markets in Kenya or Morocco's large-scale investments in solar energy production show SALs can have comparative advantage. With climate change affecting fundamental geographic characteristics, identifying the best investments for overcoming geography is increasingly important.

Institutions

Enabling environments reduce the obstacles for individuals and enterprises to thrive and grow. In SALs, particular challenges include macroeconomic instability, poor institutional and regulatory frameworks, parallel formal and traditional institutions and poor access to finance.

Climate extremes often exacerbate macroeconomic instability in SALs. The impacts of droughts and floods on agriculture and pastoralism translate into highly variable economic performance, affecting productivity, tax revenues, exports and balance of payments. As dryland economies are typically small and undiversified, with a narrow range of exports, they are also sensitive to fluctuations in global market prices of export commodities or staple foods imports. Dry developing countries are highly vulnerable to these twin problems, while high levels of debt service obligations constrain their ability to respond to fiscal challenges. When these countries lack the institutions and financial reserves to buffer international market shocks, or prices rapidly rise owing to uncontrolled inflation, impacts on the poor can be widespread.

Formal institutional and regulatory frameworks in SALs are not necessarily more or less established than those in other developing countries. The World Bank's Country Policy and Institutional Assessment assigns the six PRISE countries fairly average scores, similar to those of India.¹ However, the prevalence of people living in remote areas, belonging to marginalised groups or lacking social, economic and political capital means SALs face particular challenges in fair access to formal institutions (Castells-Quintana et al., 2015b).

Formal institutions and regulatory frameworks can also be under-resourced and face other capacity constraints in serving remote populations. On the other hand, SALs often have complex and well-established informal institutions, including drought-resilient management practices and rights for land and water (Mabhuye et al., 2015). Yet governments and investors can be blind to informal institutions, leading to inward investments that harm local communities.

Finance is another constraint for SALs businesses, often characterised by high interest rates and few formal financial institutions well adapted to serving poor people in areas with high climate risk. Collateral requirements to loans can be prohibitive, particularly in areas dominated by customary land tenure. Limited financial literacy and poor record-keeping are also challenges. Small businesses often have limited information about financial services, and financial products often do not suit their needs (Lemma et al., 2015). Most communities and small enterprises in SALs rely on more accessible, informal sources of finance, which may also be riskier (UNDP, 2008).

There are also challenges for market and financial institutions in strengthening the resilience of small

“A central question for semi-arid economies is how to sustainably and equitably overcome geography through investments in factor endowments, or development of sectors with comparative advantage.”

¹ <http://data.worldbank.org/data-catalog/CPIA>

“The common view of drylands as economically unproductive understates a diverse range of economic opportunities.”

and informal producers and enterprises.

Buyers, investors and creditors unused to drought impacts and the fluctuating productivity of drylands can lack the risk management tools to engage, or place unsustainable demands on dryland enterprises.

A sound policy environment is essential for equitable, private sector-led growth. It has also been speculated (Bowen et al., 2012) that successful climate change adaptation will impose higher demands on public policy to provide public adaptation goods (e.g. climate information), address behavioural barriers (e.g. short-termism) and overcome coordination problems (e.g. governance across watersheds). Upgrading governance is therefore a likely win-win option for semi-arid countries, although it is possible that the institutions required for growth (e.g. on fiscal management or economic regulation) might be different to those required for climate resilience (e.g. emergency response capacity).

Trade and integration

Export orientation and trade are well-documented recipes for successful growth. Yet many SALs are cut off from national and international markets. The majority of SALs are landlocked, either as entire countries, such as Burkina Faso and Tajikistan, or as dry interiors, such as northern Kenya; consequently, there are challenges in accessing coastal ports. Limited road and rail networks also constrain land travel. Pakistan has roughly 1 km of railway lines per 100 km² of territory, whereas Germany has 9 km/km² and the UK 7 km/km² (World Bank, 2015). Low population densities make road and rail infrastructure investments costlier, and heavy rains and floods further increase maintenance costs (Freeman and Warner, 2001).

However, transport is not the only barrier to market access and trade. Inadequate market distribution and supply systems and poor communication also reduce access to markets and market information

(UNDP, 2008; Lemma et al., 2015). Producers find it hard to obtain information about national and international markets, and have limited information about consumer preferences – although use of mobile telecommunications may be reducing some of these barriers (Lemma et al., 2015). Weak logistics capacity further limits the market reach of enterprises. These constraints are not unique to SALs but do have specific implications in drylands. For example, logistic constraints and limited cold storage for fresh and perishable products like meat and vegetables are a particular challenge in areas exposed to regular heat extremes. Low population densities in SALs imply poor economies of scales, meaning demand and supply are not large enough to cover marginal transportation costs (Raballand et al., 2010; Lemma et al., 2015).

The relation between trade openness and climate risk is less clear than that between trade openness and growth. On the positive side, trade generally allows countries to smooth domestic climate shocks, for example by importing food in the aftermath of a bad harvest. For well-adapted regions, sectors and businesses there may be new trade opportunities. However, trade openness also makes countries susceptible to transport interruptions and environmental shocks elsewhere. Kenyan flower producers suffered substantial losses in 2010 when volcano Eyjafjallajökull shut down the air space over Europe for six days. Supply chain management is increasingly recognised as a key climate risk for the private sector, particularly in long supply chains (Surminski, 2013).

Factor endowments

Limited transportation is one facet of poor infrastructure penetration in SALs. Electricity supply, logistics and storage, telecommunications networks, water infrastructure and other physical capital is limited and under-funded (Scott et al., 2014). Kenyan businesses lose 5.6% of



their annual sales to power outages, while losses in industrialised countries are a fraction of 1%.² In many SALs, this underinvestment reflects the prioritisation of less arid, more productive areas in national economic development; that areas of low productivity generate less tax revenue and weaker political voices for investment has been a perennial Catch-22 for drylands.

The current wave of rapid urbanisation in SALs is creating new infrastructure demands, as growing towns struggle to keep pace with housing, road and water and sanitation needs (e.g. Newborne and Tucker, 2015). Well-planned infrastructure supports growth and builds resilience to climate extremes and disasters; road networks support emergency services; storage dams help mitigate the impacts of droughts and floods. Yet poorly planned infrastructure can be vulnerable to droughts and flood damages and can have negative social impacts.

Endowments of labour and human capital in SALs are also constrained, contributing to widespread challenges with low labour productivity. Secondary education attainment is low in drylands,

² <http://www.enterprisesurveys.org/>

providing weak capacity for skilled employment (Qaisrani, 2015). Other aspects of underdevelopment also affect workers' capacity. Remote rural areas and rapidly growing informal urban areas in SALs have low coverage of health and sanitation services. Seasonal health impacts from malaria and hunger and chronic problems such as diarrhoeal disease leave negative legacies for individuals and productivity. Meanwhile, those who can – usually men and the better educated – leave to find work elsewhere, further weakening the available skills base.

Factor endowments are a key area for public and private investments. Investments in education raise human capital, and, subsequently, labour productivity. Capital investment can increase total factor productivity through upgrading infrastructure and adjusting production processes, sector priorities and the business environment. Investing in factor endowments during rapid demographic transitions and climate change has specific challenges for managing trade-offs between growth, resilience and equity.

Productivity

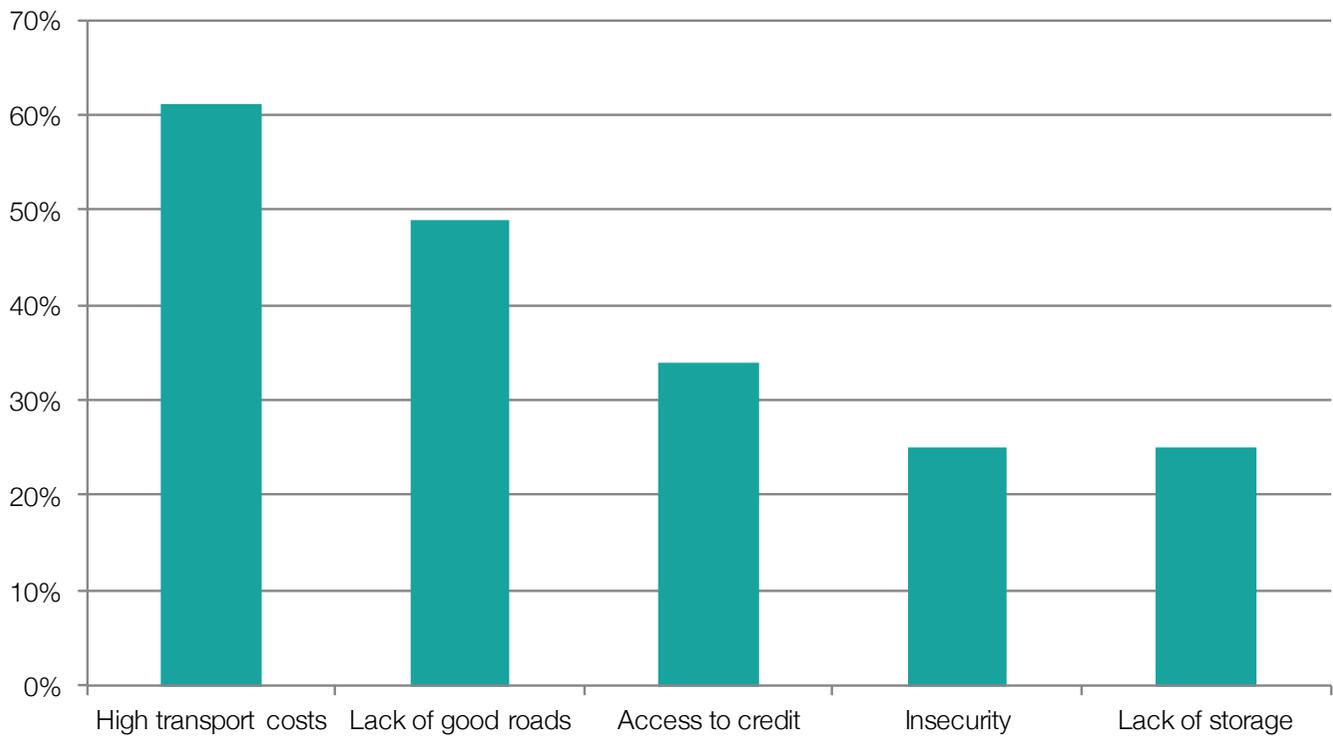
There are limited pressures for competition and high performance in

SALs, and firms have little mobility in terms of market share. Around 80% of firms in sub-Saharan Africa are informal micro- and small enterprises, and they face numerous obstacles to productivity improvements and growth. These include limited access to finance, poor contract enforcement and other constraints owing to their informality. The barriers to registering a business can be prohibitive.

Formal markets in developing country SALs are often dominated by a few large, established companies. Often only semi-private, these large firms can take advantage of state support and weak institutions to create monopolies, slow down reforms, increase costs of entry for new actors and otherwise limit competitiveness.

In the middle are small and medium enterprises (SMEs). Usually considered the most dynamic component of many economies – and crucial for creating jobs and growth – in developing country drylands SMEs make very limited contributions to GDP. This owes largely to the range of factors constraining their productivity and competitiveness (Figure 5) (Lemma et al., 2015).

Figure 4: Barriers to production in Kenya's drylands identified by business owners



Source: WFP 2013, cited in Lemma et al. (2015).

As noted above, labour productivity is a widespread constraint in SALs; labour productivity in the UK is 28 times higher than in Tanzania, for example (World Bank, 2015). Yet constraints on productivity are broader than weaknesses in human capital. There are limited pressures for competition and high performance in SALs, and firms have little mobility in terms of market share. Around 80% of firms in sub-Saharan Africa are informal micro- and small enterprises, and they face numerous obstacles to productivity improvements and growth, as noted above.

Growing climate risks pose further challenges to productivity. Heat extremes are likely to place greater stress on labour productivity, incidence of diseases like malaria could increase, droughts may lead to water shortages and supply interruptions and floods will damage equipment and interrupt supply chains. Larger enterprises are better able to overcome such constraints, while improving the position of small producers and informal micro- and small businesses is a major challenge.

3.3 Growth, equity and resilience in semi-arid lands

Developing country SALs therefore face critical challenges in pursuing economic growth that is fast, fair and resilient. Parallel systems have emerged in many SALS, with traditional and informal institutions and livelihoods on the one hand and growing investments and penetration of formal institutions, infrastructure and emerging economic sectors on the other. Harmonising these systems and protecting the rights of the poor, improving equality of opportunity and strengthening human capital is a key challenge.

Ensuring that both traditional and emerging economic activities, institutions and infrastructure are well adapted to geography is also a critical challenge. Institutions, trade, factor endowments and productivity are all likely to be affected by climate change and changing geography. Traditional activities well adapted for historic climate risk will need support if they are to remain viable, and the viability and costs of emerging

sectors need assessing in light of a changing climate.

Achieving climate-resilient equitable growth must therefore overcome both the challenges of changing climate risk and the risks of growing inequality, and also address how both sets of risks may exacerbate each other. Overcoming these challenges requires that resilience and equity are embedded within growth factors such as infrastructure and institutions, and also that growth outcomes include resilience and equity for people, not just raised levels of income.

Each of the five growth factors discussed above – geography, institutions, trade, factor endowments and productivity – has implications for growth, equity and resilience. Table 3 summarises these implications without trying to represent the complex, important and different interrelationships between the growth factors, such as the dependence of market access on infrastructure or access to natural resources being shaped by institutional frameworks.

Table 3: Factors of growth and their relation to resilience and equity

Growth factor	Fast	Fair	Resilient
Geography			
Natural capital	Endowments of natural resources (water, soil, etc.)	Access and rights of traditional users and the poor to resources	Sustainability of natural resource management, ecosystems able to absorb shocks and stresses
Institutions			
Institutional and regulatory framework	Rule of law, low administrative barriers, absence of corruption, political stability	Recognition of traditional/informal arrangements that benefit the poor, access of the poor and marginalised groups to institutions	Institutions and laws do not encourage vulnerability-creating behaviour, and are able to persist and operate during periods of crisis
Macroeconomic stability	Fiscal, price and currency stability, essential for business confidence	Impacts of macroeconomic policy on the poor	Macroeconomic structures (e.g. fiscal reserves) and government capacity able to withstand crisis
Access to finance	Access to credit and risk capital, for start-ups, micro enterprises, SME enterprises, foreign direct investment, technology	Access of poor and marginalised groups, particularly in terms of collateral requirements	Patient capital that invests in growth with depth rather than fast rates of return
Trade and integration			
Access to markets	Open to regional and world markets, good access to national economy, increasing opportunities in poor and remote areas	Increasing opportunities to the poor; protection of the poor from external markets (e.g. unfair competition)	Measures to protect against price fluctuations in external markets
Factor endowments			
Infrastructure	Transport infrastructure, communication and information technology, municipal services and energy	Access of poor and marginalised groups to infrastructure and public services, social impacts of infrastructure distributed fairly	Infrastructure planning and investments account for climate risks, and changing demands over time
Human capital	Education, health, nutrition, as they determine labour supply and productivity	Equality of access to quality public services	Health care, education and safety nets help people absorb impacts and adapt to risk
Productivity			
Firm performance	High productivity and resource efficiency in all sectors, and ability to exploit all other factors to make a profit	Creation of formal employment, and managing trade-offs between labour intensity and labour productivity	Managing trade-offs between efficiency and ability to absorb impacts
Competitive markets	Low barriers to entry and exit, level playing field, absence of monopolies, innovation and best practice encouraged	Micro & SMEs are able to compete, interface between formal and informal markets managed sensitively	Support anticipatory and responsive attributes, contingency for dis-investment

Source: Building on Bowen et al. (2012).

4. Identifying pathways towards growth, equity and resilience

Beyond recognising these individual factors for fast, fair and resilient growth are questions of their relative importance, the relationships and dependencies between them and how these may vary between different SALs. In other words, which pathways for climate resilient growth appear to be most promising in different contexts?

PRISE has launched seven research projects to address this question, following consultation with stakeholders in government and business in six dryland countries.

The seven projects are multi-disciplinary, multi-partner collaborations informed by PRISE's pathways approach to address investment and development during the next two to three decades. Each project focuses on a challenge with practical implementation questions, and entailing potential synergies and trade-offs between fast, fair and resilient modes of growth.

Each project considers a different set of relationships between growth factors, and also supports comparison of different country

contexts (Table 4, Figure 6). Questions of geography, institutions and factor endowments dominate, reflecting assumptions that (predominantly public) investments in institutional, physical and human capital offer the most likely pathways for overcoming geography. Other projects examine interactions between geography, institutions and market access and productivity, exploring the potential and necessary conditions for private sector-led growth.

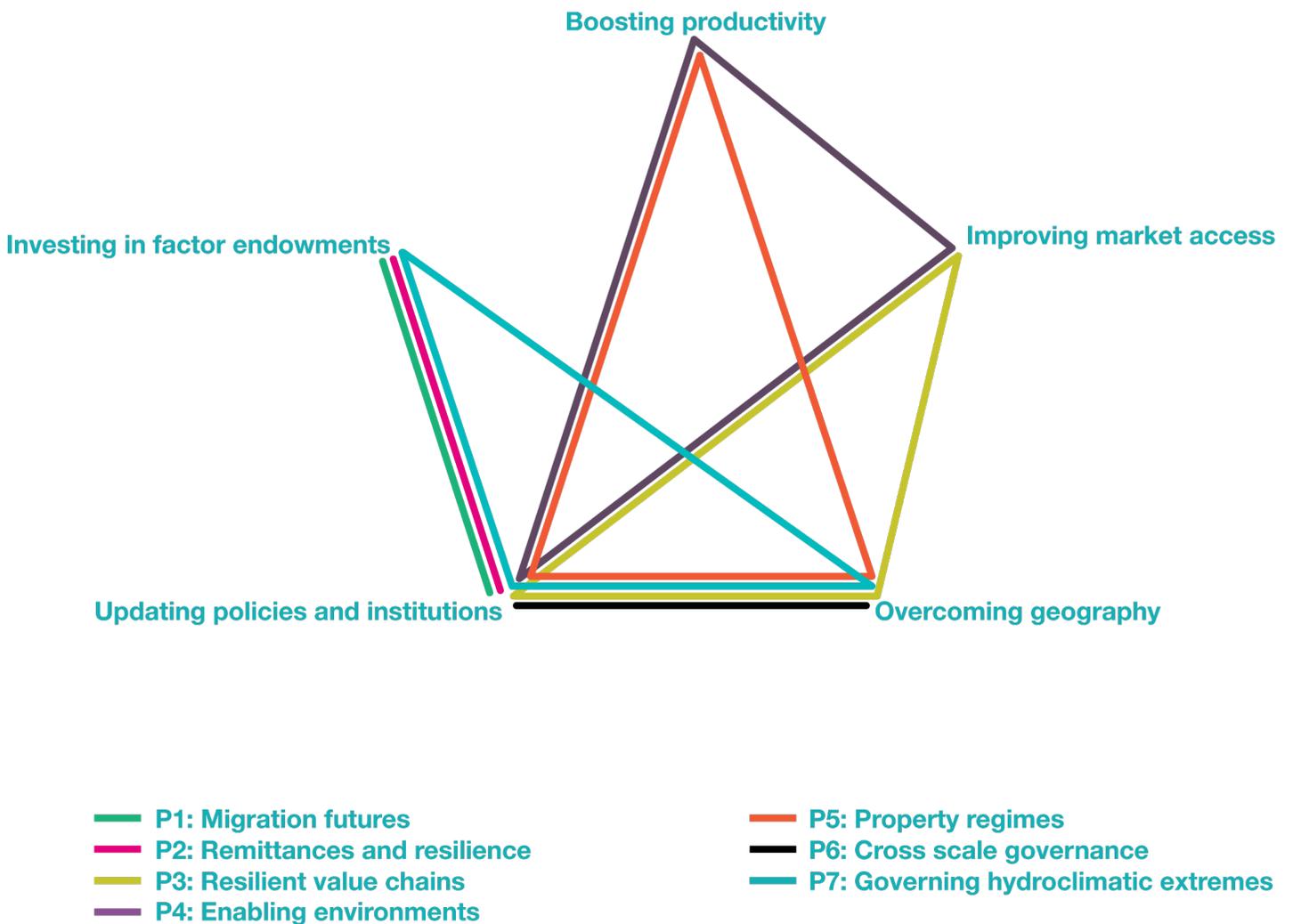
Box 1: Using climate information

Most climate adaptation research starts from climate projections, and then asks how people, governments and businesses can adapt to changing conditions. PRISE research projects take a different approach, starting from the perspectives of actors who face complex and multifaceted risks, of which climate change is just one. Understanding of current vulnerability to climate stressors is coupled with information about future climate change (variability and extremes) derived from climate models and used to contextualise challenges and decisions, and to explore their implications for future vulnerability and sustainability.

Figures 5a and 5b: PRISE research explores different pathways to climate-resilient development

Research projects	Modes of growth				
	Investing in factor endowments	Boosting productivity	Updating policies and institutions	Improving market access	Overcoming geography
P1: Migration futures	•		•		
P2: Remittances and resilience	•		•		
P3: Resilient value chains			•	•	•
P4: Enabling environments		•	•	•	
P5: Property regimes		•	•		•
P6: Cross scale governance			•		•
P7: Governing hydroclimatic extremes	•		•		•

Source: Authors.



Source: Authors.

Table 4: Summary of the seven PRISE research projects

Project	Question
<p>Project 1: Migration futures in Asia and Africa: Climate change and climate-resilient economic development (Pakistan, Burkina Faso, Kenya, Tanzania)</p>	<p>How does migration enhance economic opportunities, how do climate extremes affect migrants and how can migration be supported as an adaptation strategy while reducing impacts on women, children and the elderly?</p>
<p>Project 2: Migration, remittances, adaptation and resilience in arid and semi-arid regions of Senegal and Tajikistan (Senegal, Tajikistan)</p>	<p>How do remittances contribute to climate resilience and growth in receiving communities, and how can their positive role be strengthened?</p>
<p>Project 3: Harnessing opportunities for climate-resilient economic development in semi-arid lands: Adaptation options in key sectors (Senegal, Burkina Faso, Tanzania, Kenya, Pakistan)</p>	<p>How can vertical and horizontal transformation of value chains contribute to climate resilient economic growth, and how can businesses adapt to changing climate risk?</p>
<p>Project 4: Enabling environment for private sector/multi-stakeholder action to strengthen resilience to climate change (Senegal, Kenya, Tajikistan)</p>	<p>What are the barriers to private sector adaptation, what is the role of the public sector in shaping incentives and how can multi-stakeholder partnership benefit economic growth and resilience?</p>
<p>Project 5: Property regimes, investments and economic development in the context of climate change in semi-arid lands in East Africa (Tanzania, Kenya)</p>	<p>What is the role of institutional factors (e.g. tenure security), education and social networks in reducing climate vulnerability and enhancing growth in agriculture?</p>
<p>Project 6: Cross-boundary multi-scale governance of semi-arid lands: Implications for climate resilience and economic development (Senegal, Tanzania)</p>	<p>What are the institutional, governance and financial prerequisites for climate-resilient economic growth in semi-arid areas, and what are the constraints on public policy reform?</p>
<p>Project 7: Water governance in semi-arid lands: Political and economic insights for the management of variability and extremes in a changing climate (Burkina Faso, Pakistan)</p>	<p>How do infrastructure gaps, governance failures and institutional vulnerabilities exacerbate flood and drought risks, what are their impacts on small businesses and poor communities and what are the opportunities for reform?</p>

5. Conclusions

This paper has set out a research agenda for PRISE, providing some conceptual framing and placing the PRISE research projects in that context. Climate change is a development issue, altering some fundamental aspects of geography that are strong determinants of economic performance. Climate change and increasing climate variability pose risks to economic growth and poverty reduction, and pathways of economic development will shape resilience to climate change.

PRISE's theory of change extends this framing to the policy and practice arena, focusing on businesses, investor, and policy-makers in ministries of finance,

economics and national development. With increasing finance from climate investment funds over the next decade, and demands for the private sector to create jobs and growth, these decision-makers will play critical roles in shaping trajectories for economic growth and climate resilience in SALs. These stakeholders all have unmet knowledge needs about how to grow fair and sustainable economies in the context of climate change.

The process of identifying and developing the seven PRISE research projects involved the preparation of six thematic literature reviews, and the preparation of six country situation assessments that

included extensive consultation (Annex). The country situation assessments also provide a qualitative baseline against which the long-term contributions of PRISE and like-minded initiatives can be judged. The projects therefore balance theory-driven research questions with requests from key stakeholders for knowledge to address specific needs. The results of this research and engagement will inform planning and policy processes in the PRISE countries, and a synthesis phase (2018–2019) will generate wider insights for the design of resilient pathways in the world's SALs.

References

- Acemoglu, D., Johnson, S. and Robinson, J. (2001) 'The colonial origins of comparative development: an empirical investigation', *Am Econ Rev* 91(13): 1369–1401.
- Afrika, J.G. and Ajumbo, G. (2012) 'Informal cross-border trade in Africa: Implications and policy recommendations', *Africa Economic Brief* 3(10).
- Adaptation Sub-Committee (2014) *Managing climate risks to well-being and the economy: ASC progress report 2014*. London: Committee on Climate Change.
- Bahadur, A.V., Peters, K., Wilkinson, E., Pichon, F., Gray, K. and Tanner, T. (2015) *The 3As: Tracking resilience across BRACED*. London: Building Resilience to Climate Extremes and Disasters Programme.
- Batana, Y., Cockburn, J. and Guené, H.J.L. (2012) 'Analyse de la situation : Profil de l'équité et de la pauvreté des enfants et des femmes au Burkina Faso en 2010'. Ouagadougou: UNICEF.
- Bowen A., Cochrane S. and Fankhauser, S. (2012) 'Climate change, adaptation and economic growth', *Climatic Change* 113(2): 95–106.
- Cervigni, R., Liden, R., Neumann, J.E. and Strzepek, K. (2015). *Enhancing the climate resilience of Africa's infrastructure: The power and water sectors*. Africa Development Forum Series. Washington, DC: World Bank.
- Collier, P. (2006) 'Africa: Geography and growth', *Journal TEN*, Federal Reserve Bank of Kansas City, Fall.
- Conway, D. and Schipper, E.L.F. (2011) 'Adaptation to climate change in Africa: Challenges and opportunities identified from Ethiopia', *Global Environmental Change* 21(1): 227–37.
- Costales, A.C., Pica-Ciamarra, U. and Otte, J. (2007) *Livestock in a changing landscape: Social consequences for mixed crop–livestock production systems in developing countries*. PPLPI Research Report 07-05. Rome: FAO.
- Cotula, L. (2009) *Land grab or development opportunity? Agricultural investment and international land deals in Africa*. London: IIED.
- Coward Jr, E.W. (1980) 'Irrigation development: Institutional and organizational issues', in *Irrigation and agricultural development in Asia: Perspectives from the social sciences*. Ithaca, NY: Cornell University Press.
- Dercon, S. (2012) *Is green growth good for the poor?* Policy Research Working Paper 6231. Washington, DC: World Bank.
- Deryng, D., Elliott, J., Ruane, A.C., Folberth, C., Müller, C., Pugh, T.A.M., Schmid, E., Boote, K.J., Conway, D., Gerten, G., Jones, J.W., Khabarov, N., Olin, S., Schaphoff, S., Yang, H. and Rosenzweig, C. (2016) 'Regional disparities in the beneficial effects of rising CO2 emissions on crop water productivity', *Nature Climate Change*, doi:10.1038/nclimate2995.
- De Souza, K., Kituyi, E., Harvey, B., Leone, M., Murali, K. S. and Ford, J.D. (2015) 'Vulnerability to climate change in three hot spots in Africa and Asia: Key issues for policy-relevant adaptation and resilience-building research', *Regional Environmental Change* 15(5): 747–53.
- DFID (Department for International Development) (2009) *Growth. Building jobs and prosperity in developing countries*. London: DFID.
- Djiga, HA. (2009) 'La gouvernance locale à l'épreuve des migrations dues aux changements climatiques :
- Cas des rapports entre conseils villageois de développement et chefs traditionnels au Burkina Faso dans la gestion des conflits sociaux', *Vertigo – la revue électronique en sciences de l'environnement*, Hors série 6, November.
- FAO (Food and Agricultural Organization) (2008) *Water and cereals in drylands*. Rome: FAO.
- Freeman, P. and Warner, K. (2001) *Vulnerability of infrastructure to climate variability: how does this affect infrastructure lending policies?* Washington, DC: World Bank, Disaster Management Facility, ProVention Consortium.
- Galaty, J. (2013) 'Land grabbing in the eastern African rangelands', in A. Catley, I. Scoones and J. Lind (eds) *Pastoralism and development in Africa: Dynamic change at the margins*. Routledge: Oxford.
- Grey, D. and Sadoff, C.W. (2007) 'Sink or swim? Water security for growth and development', *Water Policy* 9: 545–71.
- Hausmann, R. (2006) *Economic growth: Shared beliefs, shared disappointments*. Working Paper 125. Pretoria: CID.
- Hausmann, R., Rodrik, D. and Velasco, A. (2005) *Growth diagnostics. The Washington Consensus reconsidered: Towards a new global governance*. Oxford: Oxford University Press.
- Hesse, C. and MacGregor, J. (2006) *Pastoralism: Drylands invisible asset? Developing a framework for assessing the value of pastoralism in East Africa*. Issue Paper 142. London: IIED.
- IPCC (Intergovernmental Panel on Climate Change) (2014) 'Climate change 2014: Impacts, adaptation and vulnerability. Part A: Global and sectoral aspects', in C.B. Field, V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M.

- Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea and L.L. White (eds) *Contribution of Working Group II to the Fifth Assessment Report of the PCC*. Cambridge: Cambridge University Press.
- Jama, B. and Zeila, A. (2005) *Agroforestry in the drylands of eastern Africa*. Call to Action 1. Nairobi: World Agroforestry Centre.
- Kabeer, N. and Natali, L. (2013) *Gender equality and economic growth: Is there a win-win?* Working Paper 417. Brighton: IDS.
- Molden, D. (2007) *Water for food, water for life: A comprehensive assessment of water management in agriculture*. London and Colombo: Earthscan and the International Water Management Institute.
- Peel, M.C., Finlayson, B.L. and McMahon, T.A. (2007) 'Updated world map of the Köppen-Geiger climate classification', *Hydrology and Earth System Sciences Discussions* 4(2): 439–73.
- Piketty, T. (2014) *Capital in the twenty-first century*. Cambridge, MA: Harvard University Press.
- Raballand, G., Macchi, P. and Petracco, C. (2010) *Rural road investment efficiency, lessons from Burkina Faso, Cameroon, and Uganda*. Washington, DC: World Bank.
- Ravallion, M. (2001) 'Growth, inequality and poverty: Looking beyond averages', *World Development* 29(11): 1803–15.
- Rodríguez-Pose, A. and Wilkie, C. (2015) *Conceptualising equitable economic growth in cities*. Cities Alliance Discussion Paper 2.
- Rodrik, D. (2003) 'What do we learn from country narratives?', in *In search of prosperity: Analytic narratives on economic growth*. Princeton, NJ: Princeton University Press.
- Rodrik, D., Subramanian, A. and Trebbi, F. (2004) 'Institutions rule: The primacy of institutions over geography and integration in economic development', *J Econ Growth* 9(2): 131–65.
- Sachs, J.D. (2003) *Institutions don't rule: Direct effects of geography on per-capita income*. Working Paper 9490. Cambridge, MA: NBER.
- Scott, A., Darko, E., Lemma, A. and Rud, J. (2014) *How does electricity insecurity affect businesses in low and middle income countries?* London: ODI.
- Shackleton, S., Campbell, B., Lotz-Sisitka, H. and Shackleton, C. (2008) 'Links between the local trade in natural products, livelihoods and poverty alleviation in a semi-arid region of South Africa', *World Development* 36(3): 505–26.
- Shepherd, A., Scott, L., Mariotti, C., Kessy, F., Gaiha, R., da Corta, L., Hanifnia, K., Kaicker, N., Lenhardt, A., Lwanga-Ntale, C. and Sen, B. (2014) *The Chronic Poverty Report 2014–2015: The road to zero extreme poverty*. London: ODI.
- Sokoloff, K.L. and Engerman, S.L. (2000) 'History lessons: Institutions, factors endowments, and paths of development in the new world', *The Journal of Economic Perspectives* 14(3): 217–32.
- Stewart, B.A., Lal, R. and El-Swaify, S.A. (1991) 'Sustaining the resource base of an expanding world agriculture', in R. Lal and F.J. Pierce (eds) *Soil management for sustainability*. Ankeny, IO: Soil and Water Conservation Society.
- Surminski, S. (2013) 'Private-sector adaptation to climate risk', *Nature Climate Change* 3(11): 943–5.
- Tsusaka, T.W., Kajisa, K., Pedo, V.O. and Aoyagi, K. (2015) 'Neighborhood effects and social behavior: The case of irrigated and rainfed farmers in Bohol, the Philippines', *Journal of Economic Behavior & Organization* 118: 227–46.
- Tucker, J., Daoud, M., Oates, N., Few, R., Conway, D., Mtisi, S. and Matheson, S. (2015) 'Social vulnerability in three high-poverty climate change hot spots: What does the climate change literature tell us?' *Regional Environmental Change* 15(5): 783–800.
- UNCCD (2010) *The forgotten billion: MDG achievement in the drylands*. Bonn: UNCCD.
- UNDP (UN Development Programme) (2008) 'From the drylands to the market: Policy opportunities and challenges in dryland areas of East Africa'. New York: UNDP.
- Walling, D.E. and Fang, D. (2003) 'Recent trends in the suspended sediment loads of the world's rivers', *Global and Planetary Change* 39(1): 111–26.
- Williamson, J. (1990) 'What Washington means by policy reform', in *Latin American adjustment: How much has happened*. Washington, DC: Institute for International Economics.
- Winters, A. (2004) 'Trade liberalisation and economic performance: An overview', *Econ J* 114(493): F4–21.
- World Bank (2015) *World development indicators 2015*. Washington, DC: World Bank.

Thematic reviews

Castells-Quintana, D., del Pilar Lopez-Urbe, M. and McDermott, T. (2015a) *Climate change and the geographical and institutional drivers of economic development*. PRISE Working Paper. London: Grantham Research Institute on Climate Change and the Environment.

Castells-Quintana, D., del Pilar Lopez-Urbe, M. and McDermott, T. (2015b) *Coping with climate risk: The role of institutions, governance and finance in private adaptation decisions of the poor*. PRISE Working Paper. London: Grantham Research Institute on Climate Change and the Environment.

Lemma, A., Jouanjean, M.A. and Darko, E. (2015) *Climate change, private sector and value chains: Constraints and adaptation strategies*. PRISE Working Paper. London: ODI.

Mabhuye, E., Yanda, P., Maganga, F., Liwenga, E., Kateka, A., Henku, A., Malik, N. and Bavo, C. (2015) *Natural capital endowment and dynamics of the changing climate in arid and semi-arid lands: experiences from Africa and Asia*. PRISE Working Paper. Dar Es Salaam: Centre for Climate Change Studies.

Qaisrani, A. (2015). *Connecting the dots: Linking climate change resilience to human capital*. PRISE Working Paper. Islamabad: Sustainable Development Policy Institute.

Wade, C., Toure, O. and Diop, M. (2015) *Gestion des risques climatiques*. PRISE Working Paper. Dakar: IED.

Country situation assessments

Gaye, A.T., Lo, H.M., Sakho-Djimbira, S., Fall, M.S. and Ndiaye, I. (2015) *Senegal: Country situation assessment*. Dakar: IED.

Mustaeva, N., Wykes, H., Mohr, B. and Kayumov, A. (2015) *Tajikistan: Country situation assessment*. Almaty: Central Asian Regional Environment Centre.

Njoka, J.T., Yanda, P., Maganga, F., Liwenga, E., Kateka, A., Henku, A., Mabhuye, E., Malik, N. and Bavo, C. (2016) *Kenya: Country situation assessment*. PRISE Working Paper. Nairobi: Centre for Sustainable Dryland Ecosystems and Societies.

Salik, K.M., Ishfaq, S., Saeed, F., Noel, E. and Syed, Q.A. (2015) *Pakistan: Country situation assessment*. Islamabad: Sustainable Development Policy Institute.

Wetta, C., Dipama, J.M., Akouwerabou, D. and Sampana, L. (2015) *Burkina Faso: Country situation assessment*. Dakar: IED.

Yanda, P., Maganga, F., Liwenga, E., Kateka, A., Henku, A., Mabhuye, E., Malik, N., and Bavo, C. (2015) *Tanzania: Country situation assessment*. PRISE Working Paper. Dar Es Salaam: Centre for Climate Change Studies.

Working papers

Deryng, D. (2015) *Climate change impacts on crop productivity in global semi-arid areas and selected semi-arid economies*. PRISE Small Grants Programme Working Paper. London: ODI.

Gilmont, N. (2016) *Analysing the economic development impact of semi-arid lands, and mitigation through food-trade water resource decoupling*. PRISE Small Grants Programme Working Paper. London: ODI.

Hartwig, R. (2015) *Perceptions of climate variability, current exposure of households to shocks and coping in semi-arid lands: A case study from the Central Plateau region in Burkina Faso*. PRISE Small Grants Programme Working Paper. London: ODI.

Jones, L., Carabine, E. and Schipper, E.L.F. (2015) *(Re)conceptualising maladaptation in policy and practice: Towards an evaluative framework*. PRISE Working Paper. London: ODI.

Newborne, P. and Tucker, J. (2015) *The urban-rural water interface: A preliminary study in Burkina Faso*. PRISE Working Paper. London: ODI.

Saeed, F., Salik, F.M. and Ishfaq, S. (2016) *Climate induced rural-to-urban migration in Pakistan*. PRISE Working Paper. Islamabad: Sustainable Development Policy Institute.

Simonet, C. and Jobbins, G. (2016) *Understanding patterns of climate resilient development: Senegal*. PRISE Working Paper. London: ODI.

Waldinger, M. and Fankhauser, S. (2015) *Climate change and migration in developing countries: Evidence and implications for PRISE countries*. PRISE Working Paper. London: Grantham Research Institute on Climate Change and the Environment.



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Research for climate-resilient futures

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