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Green Infrastructure in Fragile States

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1 Scope

1.1 Research Questions

The aim of the paper is to review evidence of the economic impacts of developing “green infrastructure” in fragile states in regards to their opportunity costs vis-a-vis “non-green” infrastructure developments. The research seeks to answer the following questions:

- Are green infrastructure choices more expensive than non-green choices?
- Do green infrastructure choices require more state involvement than non-green choices?
- Do green infrastructure choices provide more or less poverty reduction benefits than non-green choices?
- Do green infrastructure choices provide more or less employment opportunities than non-green choices?
- Are there any other co-benefits, costs or risks associated with green infrastructure investments?
- Are green alternatives considered or appraised for infrastructure projects in Fragile States?

The Review has found that:

- Upfront construction costs for green infrastructure are up to 8% higher than for non-green infrastructure projects. Climate finance is currently not being adequately captured by fragile states for such investments and governance issues may further hinder their capability to take full advantage of them.
- Green infrastructure investments require strong government participation as well as institutional capacities and capabilities that fragile states may not possess.
- Green infrastructure investments have potentially positive poverty reduction benefits such as improved agricultural yields and higher rural electrification rates, benefits that can be transmitted to other sectors of the economy not directly linked to the green infrastructure investment.
- Whilst there are examples of green infrastructure investments creating new jobs in a number of sectors, it is unclear what the employment opportunities advantages are in respect to traditional infrastructure investments. The correct market conditions (i.e. labour regulations or energy demand) are also required in order to maximise employment creation opportunities. Such factors that may not be fully exploited by fragile state governments lacking the capacity to do so.
- Green infrastructure investments have a number of co-benefits including increased energy security and improved health outcomes, whilst a potential reduction of a country’s vulnerability to the negative effects of climate change being arguably the most important co-benefit for such investments in a fragile state context.
- There is (limited) evidence that green infrastructure options are taken into consideration during the project appraisal process. Engagement tends to mostly occur for projects that are specifically designed with green goals, hence there is no data that shows the decision making processes that lead to a shift towards any green alternative. Comparisons of costs, co-benefits, poverty reduction benefits or employment creation benefits between the two typologies are also not evident.

2 Methodology

The paper is a desk-based review of a number of articles focussed on infrastructure in fragile states and green infrastructure from non-fragile states in order to identify issues that are likely to relate to green infrastructure in fragile states, additional material relevant to climate change and security is also reviewed to look at the effects of climatic events and investment in green infrastructure on stability in fragile or conflict afflicted states. The review has not been able to review any literature discussing green infrastructure in fragile states as there is a lack of relevant articles and materials focussed on its analysis.

The review begins by defining fragile states and infrastructure in the context of the review, it proceeds to look at the costs of investing in green infrastructure and it's applicability to fragile states and moves on to review the role of government, sources of finance, employment creation potential and poverty reduction benefits and co-benefits of green infrastructure. The review concludes with a short summary of the lessons learnt.

2.1 Defining Fragile States

There is no internationally defined agreement as to what constitutes a fragile state. The UK's Department for International Development (DFID) defines fragile states as "those countries where the government cannot or will not deliver core functions to the majority of its people" (DFID, 2008)/ The OECD-DAC has a similar definition of states that 'lack political will and/or capacity to provide the basic functions needed for poverty reduction, development and to safeguard the security and human rights of their populations (OECD, 2007). There are many different types of states that can be classified as "fragile" these include states with weak governance capacity, conflict and post-conflict areas as well as states that may have a strong capacity to govern but are insensitive to the demands of their own citizens.

For the purposes of this review the countries that are considered to be fragile states are those found within the World Bank's Country Policy and Institutional Assessment (CPIA) and the Fund for Peace's Failed States Index as well as any additional countries DFID also considers to be failed states according to its budget allocations to what it defines as fragile states¹. The DFID "how to" guidelines on identifying fragile states (DFID, 2012), which this review follows in its definition of a fragile state, also recommends including countries within the Uppsala Conflict Database², however this particular database is extensive in its inclusion of countries involved in conflicts and as the exact method that DFID uses to choose it's countries is not available it has hence been excluded from the analysis as it also includes countries such as the United States of America, Spain, China, the United Kingdom etc. would not be generally classified as fragile states. A full list of countries included in the definition is included in Annex I.

2.2 Defining Green Infrastructure

For the purposes of this review the definition of Green Infrastructure will follow the definition provided by the requestor, where Green Infrastructure includes:

- Resource efficient Infrastructure
- Low Carbon Infrastructure
- Climate Resilient Infrastructure

Such definitions would include public transportation systems, climate resilient or mitigating transport infrastructure (i.e. flood resistant roads), renewable energy infrastructure, water conservation and efficiency infrastructure (i.e. improved irrigation systems) as well as efficiency improvements such as low consumption lighting etc.

¹ <http://www.publications.parliament.uk/pa/cm201012/cmselect/cmintdev/1133/113305.htm>

² <http://www.ucdp.uu.se/gpdatabase/search.php>

3 Literature Review

3.1 Comparing Costs: Green vs. Non-Green Infrastructure

In terms of the cost for adaptation to climate change in infrastructure, a 2010 World Bank paper has shown that such costs are quasi negligible, with the cost of adapting to climate change representing an additional 1% to 2% of the total cost of infrastructure provision, with the lowest cost levels in sub-Saharan Africa, North Africa and South Asia where the level of infrastructure is already low, hence the additional costs of adapting infrastructure would be a minimal addition to their construction costs (World Bank, 2010). The paper also shows that low income countries (such as most fragile states are) would have some of the lowest infrastructure adaptation costs, especially for transportation and water distribution infrastructure.

Using the example of the construction sector, there is high potential for monetary savings associated with the construction of green buildings or of retrofitting existing buildings with apparatus such as solar water heaters. The long-term cost savings in terms of energy usage would outweigh the initial construction (or retrofitting) costs and coupled with the rising cost of traditional fossil fuels the potential for increased future savings could be high (UNEP, 2011).

Further research carried out at the global level by the OECD (2012) shows that the global incremental value of switching from traditional infrastructure projects to green infrastructure projects would cost between US\$ 0 billion to US\$ 400 billion per year between 2015 and 2020, i.e. an increase of between 0% and 7% in construction costs per year (see table 1 below).

Table 1: Global Traditional vs. Green Infrastructure Costs 2015 - 2020

Sector	Traditional Infrastructure Cost (US\$ Billion / year)	Green Infrastructure Cost (US\$ Billion / year)
Power Generation	320	380
Electricity Distribution	270	260
Buildings	320	620
Industry	280	310
Water	772	772
Telecoms	646	646
Road	245	< 245
Transportation Vehicles	3,300	3,370
Rail	120	120
Airports	120	< 120
Ports	40	40
Oil & Gas Distribution	155	< 155
Total	6,590	6,500 - 7000

Source: OECD (2012)

Comparing the actual costs of green vs. traditional infrastructure in fragile states is problematic due to a lack of research on the topic, especially in fragile states. Although not a fragile state, research was carried out to estimate the cost difference between traditional road upgrading and climate resilient road upgrading works, the research found that upgrading to the climate-resilient version would only cost between 5% and 7.6% more than would have otherwise have been spent, whilst maintenance costs would be 30% for traditional structures than for climate resilient structures (World Bank, 2010a).

The applicability of the findings of these studies to a fragile state situation remains uncertain as there are varied factors at play that may either negate such cost savings or not allow their effective

implementation due to a lack of the required implementation processes (i.e. technical capabilities of government capacity).

The evidence thus points to the fact that where it is possible to substitute traditional infrastructure with green infrastructure, especially where there is no pre-existing infrastructure base; the initial upfront cost will be higher but up to a maximum of about 7% to 8%. The issue of higher up-front costs does however remain problematic for fragile states as they are typically more resource constrained, hence higher construction costs (even where there may be longer-term savings) may not be appealing to their governments.

In terms of accessing finance for green infrastructure projects, there various modalities that could be theoretically used (UNEP, 2012):

- *Emerging Green Markets:* A certain amount of green markets have come into existence as a result of investments in green growth products. Capital flows in green markets have noticeably increased, i.e. new investments in renewable energy projects have increased since 2004 where they accounted for US\$ 33 billion to 2010 where they reached US\$ 211 billion (UNEP, 2012).
- *Innovative Financial Instruments:* New financial instruments aimed at easing investment in green markets have emerged over the last ten years, including instruments such as carbon finance, green stimulus funds, microfinance, weather insurance products, green bonds etc.
- *Essential Infrastructure Institutions and Systems:* A number of institutions have emerged that provide access to finance for what has been deemed to be “essential” green infrastructure (i.e. specialised financial institutions such as green investment banks or payments for ecosystem services) as well as a number of systems being set up to measure sustainability and climate competitiveness at the national level.
- *Drivers of Green Investments:* Specific policy aimed at supporting investment in green infrastructure investment coupled with market demand for such investments as well as innovative private and public financial mechanism have allowed green markets to emerge and have particularly fostered growth in the renewable infrastructure sector.

There are however also a number of challenges that fragile state governments will face when mobilising finance for green infrastructure investments, these are challenges that may prove to be especially problematic for fragile states that want to implement green infrastructure investments (UNEP, 2012):

- *Market Failures:* Market failures or policy barriers can make green infrastructure investments unattractive (especially to private sector enterprises) as they can reduce the risk-adjusted private returns to investment in green infrastructure projects in the main green growth sectors such as renewable energy, energy and resource efficiency, transportation, water and sanitation and forestry.
- *Perception of High Risks:* There are higher perceived risks in green sectors that have a longer investment payback horizon due to uncertainties in future climate change policies, technological uncertainties or lack of information and awareness on the exact returns to “unbankable” green projects such as cost-savings efficiency measures in physical assets.
- *Absence of Policy & Regulations:* A lack of regulations or policy aimed at measuring the externalities of climate change (i.e. carbon pricing or proper evaluation of the economic benefits of environmental systems or natural resources) hinder the proper estimation of the value of green infrastructure investments and hence do not show the correct long-term benefits of investing in green infrastructure, rather fuelling short-term thinking and investments in markets.
- *Low Access to Finance:* Low levels of finance and the ability to access finance in developing countries (especially in fragile states) can hinder investments in green infrastructure, more so if the

investments are meant to be carried out by local private sector participants. Reduced availability of money for such investments on behalf of the government are also a limiting factor that needs to be taken into account.

Whilst there are multiple international funds that are aimed at resolving the issue of access to finance, such as the UNEPs Green Climate Fund, fragile states may face issues accessing these sources of green infrastructure finance. In theory, such mechanisms should allow unconditional access to finance for least developed countries (due to their relatively small, if not negligible, role in the production of greenhouse gas emissions) the reality is that they are often hindered from doing so. Multiple checks and balances are placed on such mechanisms to prevent non-developmental states from accessing them (thus potentially propping up “undesirable” regimes) unless they meet stringent good governance requirements (Lockwood, 2012). Due to pervasive political instability that many fragile states face, these monitoring systems may be an additional obstacle for them to access green financing mechanisms.

Looking at the amount of green infrastructure finance that actually goes to fragile states (table 2 below) we can see that for the World Bank’s Clean Investment Fund (which is divided into four funds that include forestry, climate resilience, clean technology and renewable energy investments), 7% of funding goes to fragile states (in total) of which 99% fall into the green infrastructure category, representing a total of 6.5% of available CIF funding.

Table 2: Clean Investment Fund Expenditure on Fragile States in 2011

Fund Type	Total Fund ³ (US\$ million)	Fragile States Fund Capture (US\$ million)	% Capture Fragile States	Fragile State Funds for Green Infrastructure (US\$ million)	% FS Capture for Green Infrastructure	% Total funds for FS GI ⁴
Clean Technology Fund	16,226	250	1.5%	250	100%	-
Pilot Climate Resilience Fund	182	171.2	94%	161	54%	-
Forest Investment Programme	629	0	0%	0	0%	-
Renewable Energy Programme	746	746	100%	746	100%	-
Total	17,783	1,167	7%	1,157	99%	6.5%

Source: World Bank (2011)

Another major source of international finance is the Global Environment Facility fund, which has set up three funds specifically for low income countries. The first is the Least Developed Country Fund which is aimed at providing LDC’s with financial support for the achievement of their climate change adaptation strategies. The second fund is the Special Climate Change Fund which was set up to support technology transfer and adaptation in developing countries and is split into two components (as per table 2 below). The results from here show a slightly better picture in terms of green infrastructure funds captured by fragile states than the WB’s CIF figures.

³ Included Core & Leveraged Funding

⁴ Green Infrastructure

Table 3: Global Environment Fund Expenditure on Fragile States in 2011

Fund Type	Total Fund ⁵ (US\$ million)	Fragile States Fund Capture (US\$ million)	% Capture Fragile States	Fragile State Funds for Green Infrastructure (US\$ million)	% FS Capture for Green Infrastructure	% Total funds for FS GI
Least Development Country Fund	1,076	436	41%	237	22%	-
SCCF - Adaptation	891	26	3%	26	100%	-
SCCF - Technology Transfer	27	0	0%	0	0%	-
Total	1,994	462	23%	263	57%	13%

Source: GEF (2011)

What the above information shows us is that whilst there may be a theoretical availability of funding for green infrastructure in fragile states, the reality is that only a small proportion of these goes to green infrastructure projects. It is also important to consider that for some individual components of these funds (i.e. the CIF Pilot Climate Resilience Fund or the GEF LDC fund) the percentage of funding to fragile states greatly increases, hence availability is also determined by what how the funds are structured and their main objectives.

3.2 The Role of Government in the provision of green infrastructure

The role of government in the provision of infrastructure is fundamental in any fragile state or post-conflict situation as the government needs to play a number of different roles in order to efficiently encourage the construction of infrastructure (Mott MacDonald, 2005):

- *Stakeholder Engagement:* In the case of stakeholder participation for infrastructure construction, the government is both an active stakeholder and should also be an enabler for other stakeholders to engage one-another as well as having channels through which it can engage other stakeholders in any green infrastructure decision making process. In terms of green infrastructure these issues become particularly relevant due to the oppositional forces that come in play when traditional sources of growth or typologies of infrastructure are replaced by “green” typologies, especially where vested interests or certain stakeholders are threatened i.e. deciding to make a hydroelectric power plant as opposed to a fossil fuel powered plant. The government can help mobilise support (where it has capacity to do so) aimed at supporting green infrastructure investment decisions but this requires a strong evidence base in support of the green infrastructure investments (Dupar, 2012), which may prove to be problematic for resource constrained fragile state governments.
- *Good Governance:* The government needs to enforce good governance procedures both within its own institutions and within contractors that it engages to undertake infrastructure construction through efficient, accountable and transparent procurement procedures that need to be set up to monitor both parties. In terms of green infrastructure investments in fragile states, there is also the issue of how governance affects pro-poor decision making processes and the ability of government to limit the amount of “rent” that the better-off in fragile states are able to capture from infrastructure investment decisions (Pearce, 2005).
- *Long Term Commitment:* Infrastructure construction generally requires a long-term commitment on behalf of the contracting body (i.e. the state) as projects can take a long time to come to fruition. This is especially true of green infrastructure projects which only show savings (or returns to

⁵ Included Core & Leveraged Funding

investment) in the long-run. Hence government commitment to long term planning and support for such infrastructure is required. Long-term planning is also important as investments in green infrastructure, especially for adaptation to climate change purposes, need to be undertaken at the right time i.e. postponing investment in climate resilient (i.e. flood resistant) roads may end up costing more in the future due to agglomerated maintenance and reconstruction costs, however carrying out immediate upgrades to all roads would be prohibitive, hence a long term plan of restricting and prioritisation is necessary (Arndt et al. 2011).

- *Regulation & Policy:* Another important role the government is required to play is to set up the correct policies and regulatory environments aimed at facilitating investments in green infrastructure. For example, within the construction sector there may be a lack of incentives to invest in climate compatible infrastructure i.e. housing unless the government introduces (or updates) and enforces climate compatible building codes (Ryan-Collins et al. 2011). Regulation and policy changes governments can also be useful in removing negative distortions (such as fossil fuel subsidies) that hinder investments in green infrastructure.
- *Resource Rights:* The issue of resource rights (including land rights) is complex and need to be tailored to the individual culture and society that they represent (Pearce, 2005). The basic issue however remains the need for resources to be properly managed in a sustainable manner and allow all members of society to have well regulated access to resources (including a transparent and legitimate land rights acquisition system).

Whilst these are the roles that governments would have to fulfil under normal circumstances in order to incentive and properly regulate investment in green infrastructure on a long-term basis, the reality is that fragile states may not be properly equipped to deal with such issues. As most fragile states are relatively low in terms of governance capacity, as shown in the World Bank's ease of doing business index⁶ (ERD, 2009), they may not be able to properly carry out the above functions as issues of limited capabilities and resources, corruption and tenuous (or perhaps even non-existing) political stability can all hinder the implementation of the correct regulations, policies and institutions that would promote investments in green infrastructure.

3.3 Green Infrastructure & Poverty Reduction

Infrastructure deficits are a serious impediment to growth, with higher levels of infrastructure stock in any given country positively affecting long-run growth and reducing inequality as a World Bank study of over 100 countries between 1960 and 2005 has shown (Calderon & Serven, 2008). Green infrastructure investments can also be a source for further economic growth as they can be a source of economic competitiveness at the micro level (i.e. for individual firms) as well as the macro level, potentially allowing a fragile state to create a source of comparative advantage vis-à-vis other nations that do not invest in green infrastructure through improved resource efficiency and lower production costs.

At the household level there is also scope for poverty reduction processes to come into play through green infrastructure, for example, a Public-Private Infrastructure Advisory Facility Project carried out in Rwanda in 2008 has helped provide reliable and sustainable lighting sources to rural inhabitants by helping to set up off-grid power generation facilities (through solar charging units) coupled with low energy use LED lights, benefitting 42,000 people by allowing productivity to improve i.e. in small businesses as well as benefit schoolchildren who are able to study for longer periods of time (PPPIAF, 2012).

Green investments in agricultural infrastructure (and practices) may become a de-facto requirement in order for fragile state agricultural producers to enter high-income markets. The example of the GlobalGap agricultural certification scheme (which includes compliance to environmental standards

⁶ See Annex II for a sample selection of fragile state rankings

such as water usage limits) shows how agricultural producers can be excluded from many high-income country retailers (such as Walmart, Tesco, Aldi etc.) if they do not conform to such schemes (Ellis & Keane, 2008). Such a shift for fragile state agricultural producers, especially where agricultural is still at a low level of production intensity would not have an overtly negative impact on farmers (especially smallholder farmers) as has been shown in Mozambique (Wiggins et al. 2012).

Green infrastructure investments in agriculture may also be desirable in terms of securing livelihoods as they can help improve (or at least maintain) average crop yields in countries which will be negatively affected by climate change as well as help smooth out crop yields in general, creating more security in livelihoods for farmers as well as allowing them to planned production in a reliable manner (IPCC, 2007). A study carried out in Gambia showed that there would a potential increase in yields from an estimated 2% - 13% through non-green infrastructure to a green infrastructure scenario where crop yields would instead increase between 13% to 43% (between 2010 and 2039) if farmers invested in green infrastructure (such as improved cultivars and irrigation systems as well as improved crop fertilisation systems), whilst reducing the variability in crop production within the same period (Nije et al. 2006).

At the macroeconomic level there are issues of improved competitiveness gains from investing in green infrastructure for fragile states. Improved resource efficiency through reduced usage of resources (i.e. the implementation of recycling facilities or more efficient energy and water usage) as well as through better transportation links (i.e. efficient public transport or climate resilient transportation systems) will improve the economic competitiveness of fragile states and help create further employment opportunities within the country (ODI, ECDPM & DIE, 2012).

Positive livelihood effects will also be gained in industries that are not directly related to green infrastructure investment choices. For example, where there is scope for improved environmental conservation procedures to be implemented (i.e. through forestry conservation choices) there can be positive knock-on effects on sectors such as tourism which may be reliant on the availability of natural resources to attract tourists (i.e. gorilla's in Rwanda), sectors that can also be integrated into any green growth efforts with positive livelihood effects, as was shown in Nicaragua where for every job created in the "eco-tourism" sector translates into two jobs in the wider economy (UNEP, 2011). These positive effects also tend to be circular, especially on sectors that rely on the preservation of natural resources such as tourism i.e. improvements in conservation efforts can lead to increased tourist arrivals (generating more jobs and securing more livelihoods for rural communities in the process) which in turn can incentivise governments to strengthen their natural resource conservation efforts (FAO, 2011).

3.4 Green Infrastructure & Employment

Investments in green infrastructure can potentially lead to employment generation in fragile states especially in the energy, waste and conservation infrastructure segments. The small scale and off-grid nature of certain types of green infrastructure investments can lend themselves well to situations where there is no well-regulated or well organised central distribution system (i.e. for energy or water).

In terms of green energy infrastructure, by 2010 worldwide employment in renewable energy has grown to around 3.5 million people (UNCTAD, 2010) with moderate potential for employment creation through investment in renewable energy sources in fragile states i.e. in Nepal around 175,000 biogas plants were set up between 1992 and 2005 which led to the creation of around 65,000 jobs and supported over 150 firms involved in the construction, maintenance and light manufacturing of these biogas plants (UNCTAD, 2010). There is also evidence that renewable energy projects have a higher job creation potential than their non-renewable counterparts since they have a higher job creation potential per megawatt, unit of energy and dollar of investment, however it is important that these predictions depend on a number of factors that may not be applicable to fragile states i.e. the demand for energy within the market, the regulations that incentivise investments in renewables, labour market regulations and skill availability (OECD, 2011).

There are a number of examples where small scale projects have helped create jobs, such as a waste recycling project in Burkina Faso that helps employ around 2,000 waste pickers and a compost generating project in Dhaka which has helped generate 1,200 new jobs (UNEP, 2011). Grossman et al. (2009) show how a GTZ supported labour intensive waste management programme implemented in Sierra Leone has employed a total of 710 young people within the waste management system as well creating a total of 450 sustainable jobs within the project itself. The project also generates income through waste collection fees which shows that certain green infrastructure projects also have the potential to become financially self-sustaining.

Environmental conservation activities can also help generate employment i.e. a joint USAID and ACC⁷ project in Afghanistan aimed at improving conservation of Afghanistan's already severely eroded natural resource base (which was negatively affecting the livelihoods of an estimated 80% of the Afghan population) set up 300 initiatives with local communities and helped generate over 700,000 FTE⁸ employment days (ACC, 2007).

On the other hand, traditional (non-green) large scale infrastructure projects can also help employment recovery in fragile states. McCutcheon (2008) states that the use of labour intensive methods of production, as opposed to capital intensive investments in infrastructure development projects, can be a useful way to create employment opportunities as well as to provide essential infrastructure for the economy, as long as construction efficiency is taken into the same consideration as the employment creation effects. Examples of such construction projects can be seen in Mozambique with its Feeder Roads Programme (FRP) which began in 1981 (and is still currently running) which has employed more than 40,000 people from rural communities (McLeod & Davalos, 2008).

3.5 Co-Benefits of Investments in Green Infrastructure

Addressing the effects of climate change through the implementation of green infrastructure will be fundamental to address security and stability issues in fragile states. According to Smith & Vivekanada (2007), the consequences of climate change can have further negative impacts on pre-existing social and political tensions within fragile states by compounding political and economic instability as well as increasing the likelihood of large-scale migration.

The importance of addressing the effects of climate change is also highlighted by Bierman and Dingwerth (2004) who state that the effects of climate change will decrease the capability of governments to escalate the development process without the aid of other countries, a situation that fragile states already tend to fall within, hence failure to address climatic concerns may further exacerbate their already tenuous position. Finally, the GACGC⁹ (2007) states that climate change will have two major impacts on fragile states: fragile states will suffer "relatively severe" impacts and will not have the capacity to respond to these impacts effectively.

Green infrastructure can help provide a number of benefits such as increased energy security, improved sanitation and healthcare and less polluting transportation systems, that can improve people's lives and help reduce, or at least mitigate to some degree, sources of conflict such as natural resource usage. One direct benefit is energy security through the use of renewable energy technologies (RETs) which can be scaled up from small energy production units that do not require connections to national grids all the way up to infrastructure such as hydroelectric power dams (which are more resource intensive and thus could be problematic in a fragile state situation), these sources of energy can help rural communities gain access to energy as well as provide a stable source of energy for the country as a whole, reducing foreign dependency on energy.

There are however two problems with RETs in a fragile state context in that they require political commitments such as setting environmental targets (which fragile state governments may not have the

⁷ Afghanistan Conservation Corps

⁸ Full Time Equivalent

⁹ German Advisory Council on Global Change

capacity to do, at least in the short term) as well as the implementation of policy that supports the uptake of RETS such as reduced subsidies to fossil fuels or monetary incentives to use RETs, which may not be possible for governments with monetary availability problems (UNEP, 2011).

Access to international financing mechanisms such as the Clean Development Mechanism or the World Bank's Climate Investment Fund can help resolve these issues (UNCTAD, 2010) but due to the large accountability requirements that these funds often impose they may be out of reach for certain fragile state governments (as shown above). The long-term benefits of increasing the use of renewable energy sources would however help to offset any growth losses that may occur as a result of expected increases in fossil fuel prices¹⁰ as there is a negative link between increases in fossil fuel prices and GDP in developing country contexts, especially for net oil-importing countries (Te Velde, 2011 and Rasmussen & Roitman, 2011).

Another direct benefit of green infrastructure are the net health benefits that they should encourage especially for infrastructure that is critical to human health and that can be adversely affected by climatic events such as water distribution and sanitation, however negative health impacts can be reduced where there is infrastructure specifically designed to attenuate (or negate) the impacts of climate change (McMicheal et al. 2003). An example of improved health co-benefits to green infrastructure (in the broader sense) is the use of improved charcoal stoves in Senegal (Bystricky et al. 2010) which has not only resulted in improved finances for the household using them, created jobs in stove manufacturing but has also resulted in less illness for the beneficiaries as medical consultations in relations to skin, eye and respiratory diseases decreased due to the lower levels of particle pollution.

There are also gender equality benefits to green infrastructure investments. Perch (2010) states that women and girls in poorer countries tend to face the worst effects of climate change impacts as they tend to work in at-risk sectors (such as agriculture) and have less assets to help them recover from any negative impacts. Investments in green infrastructure can have positive gender outcomes i.e. the Senegal stove example above also reduced the both the amount of time women had to spend collecting firewood as well as overall cooking times as the stoves were more fuel efficient, using less fuel and producing more heat at the same time. Improved employment opportunities for women can also be created through green infrastructure investments i.e. a reforestation programme in Tanzania which began in 2000 has helped generate 50 full time jobs and 600 seasonal jobs, of which a third went to women (Bystricky, 2010).

3.6 Are Green Alternatives Considered for Infrastructure Project Appraisals in Fragile States?

Understanding whether green infrastructure alternatives and issues are considered when undertaking infrastructure investments in fragile states requires an analysis infrastructure projects appraisals and whether green alternatives, issues or objectives are included in such considerations.

The following table looks at a selection of infrastructure project appraisals for the African Development Bank in Fragile States and points out whether there have been any considerations given to green alternatives for construction. The projects chosen for the table were infrastructure projects that could have included a green component (following the definition highlighted in the methodology) and were carried out in Fragile States. The table shows what potential green components the project could have included, whether it considered any "green issues" (i.e. environmental impacts or climate mitigation/adaptation potential) and whether the project considered green alternatives.

¹⁰ i.e. the US Energy Information Administration expects oil prices per barrel to reach US\$ 145 by 2035, whilst the UK's Department for Energy and Climate Change expects oil prices to increase to US\$ 130 per barrel by 2030.

Table 4: African Development Bank Infrastructure Project Appraisals

Project	Country	Possible Green Component	Green Component Built?	Main Objective	Green Considerations	Green Alternative Considered?
Rural Infrastructure Rehabilitation	Central African Republic	Climate Resilient Roads	No	Rehabilitation of roads to increase access to markets for agricultural producers.	Environmental Impacts Considered, Mitigation impacts also considered and evaluated as positive (net reduction in CO2 from better transport infrastructure) but not the main objective of project.	None
3 Towns Water Supply & Sanitation Project	Sierra Leone	Sustainable Water Supply Management	No	Make water & Sanitation availability as widespread as possible in urban areas.	Environmental impacts considered. No "green" objectives included (i.e. natural resource management).	None
Emergency Power Infrastructure Rehabilitation Project	Zimbabwe	Renewable Energy	No	Increase energy outputs in the country through construction of Coal power plants.	Environmental impact assessments have been carried out.	Yes, but rejected due to limited resource availability.
Togo/Burkina Faso Road Rehabilitation Project	Togo	Climate Resilient Roads	No	Improve transport logistics chain.	Environmental Impact Assessments Carried out and negative impact mitigation strategy outlined.	None
Darfur Water Project	Sudan	Sustainable Water Supply Management	No	Provide water services as a means to reduce conflict over limited water resources.	Sustainability of water resources considered. An environmental impact analysis was also considered.	Yes, but not elaborated.
Togo/Benin Road Rehabilitation	Togo	Climate Resilient Roads	Yes	Reduce Traffic Congestion on Road.	Climate resilience considered and included in the construction.	Yes, as part of main proposal
Kenya Road Rehabilitation	Kenya	Climate Resilient Roads	Yes	Improve regional integration through road rehabilitation.	Environmental Impacts considered.	Yes, as part of main proposal
Ethiopia Road Upgrading Project	Ethiopia	Climate Resilient Roads	Yes	Expand and improve current road infrastructure.	Environmental Impacts considered.	Yes, as part of main proposal
Kenya & Ethiopia Road Corridor Project	Kenya - Ethiopia	Climate Resilient Roads	Yes	Improve trade between Kenya and Ethiopia.	Environmental Impacts considered.	Yes, as part of main proposal

Source: African Development Bank (2012)

The table above shows that the majority of AfDB infrastructure projects that could have included a green component were predominantly road rehabilitation projects, with only two water provision projects and one energy provision project. Of the selected projects, the majority did actually include “green” considerations in their design process and all projects carried out an African Development Bank mandated environmental and social risk impact assessment. In terms of project objectives, none of the projects actually cited climate change mitigation or adaptation issues as their objective as all the infrastructure projects were carried out to promote wider developmental objectives such as strengthening trade or improve access to markets.

The AfDB project appraisals do not however show a cost comparison between green and non-green infrastructure alternatives as they provide a total cost for each project, hence the ability to independently compare which of the two types of projects are cheaper or more cost-effective in the long run is limited. However, those projects that did include green considerations did not consider them as alternatives, but rather they were included in the main project as a long-term sustainability measure (especially for long term road maintenance issues), which shows that (at least for these projects) the appraisers have considered long term maintenance costs. The project appraisals also do not show what other advantages (i.e. job creation or wider social/economic benefits) would be accrued by choosing green infrastructure alternatives over non-green infrastructure.

The ADB infrastructure projects PDS's¹¹ did provide a certain amount of information, following the same selection criteria as the AfDB projects, (but limited to projects carried out in 2012 due to the large amount of projects carried in their database). As table 5 (below) shows, a number of what can be considered to be green infrastructure projects were carried out and the data in the PDS's show that green options were fully considered. However, similarly to the AfDB project appraisals; there is no basis of comparison in terms of job creation, cost efficiency or any potential wider social and economic co-benefits with non-green alternatives.

Table 5: Asian Development Bank Infrastructure Project Appraisals for 2012

Project	Country	Possible Green Component	Green Component Built?	Main Objective	Green Considerations	Green Alternative Considered?
Afghanistan Rural Irrigation Project	Afghanistan	Sustainable Water Use	None	Improve access to irrigation for farmers in Northern Afghanistan	None	None
Sustainable Urban Transport Network in Dhaka	Bangladesh	Public Transport, Climate Resilient infrastructure	Yes, Bus Rapid Transit System	Provision of sustainable public transport in Dhaka	Environmental Impacts considered.	Yes, as part of main proposal
Transport Network Dev.	Afghanistan	Public Transport, Climate Resilient infrastructure	Unknown	Improve road transport network in Afghanistan	Unknown	Unknown
Road Network Upgrade	Timor-Leste	Climate Resilient Roads	None	Improve road transport network in Timor-Leste	None	None
Water Supply Project	Timor-Leste	Sustainable Water Use	In Progress	Improve access to safe drinking water in Timor-Leste	Sustainable Water Management	Yes, Implementation of sustainable water management Practices

¹¹ Project Data Sheets

River Basin Improvement Project	Nepal	Sustainable Water Use	In Progress	Improve water security and resilience to potential climate change impact	Sustainable Water Management	Yes, as part of main proposal
Irrigation Management Programme	Bangladesh	Sustainable Water Use	In Progress	Increase efficiency and sustainability of water resource management	Sustainable Water Management	Yes, as part of main proposal
Coastal Climate Resilient Infra.	Bangladesh	Multiple	In Progress	Increase climate resiliency of coastal areas	Multiple Infrastructure Projects Aimed at Improving Coastal Climate Resilience	Yes, as part of main proposal
Clean Energy Project	Sri Lanka	Renewable Energy	In Progress	Improve Access to and Security of Energy Supply	Wind & Solar Power Energy Production Infrastructure	Yes, as part of main proposal

Source: Asian Development Bank (2012)

The same exercise was attempted for the IFC project Database, the World Bank Project Database, the PPIAF¹² project database and the PIDG¹³ project database. The World Bank and the PPIAF databases contained very succinct project descriptions with no rationale or appraisal included. The IFC database did not provide any results whilst the PIDG database provided project names but no description of activities.

Though this has been a limited attempt to gather information on the choices made in regards to green infrastructure investment decisions, the data does show that where information is available, green infrastructure considerations do occur, however the issue of comparability (i.e. in terms of costs, employment creation or co-benefits) between green and non-green projects remains as no such comparison seems to be carried out in project evaluations.

4 Key Lessons

Do green infrastructure choices provide cost savings vis-à-vis non-green infrastructure choices?

The evidence suggests that green infrastructure projects bring higher upfront costs (between an estimated 2% and 8% higher) than their non-green counterparts. Higher upfront costs may be problematic for fragile state governments that may be limited in terms of monetary resources. A review of project appraisals of donor funded green infrastructure projects in fragile states does not provide any cost comparison vis-à-vis non green alternatives; hence independent cost comparisons between the two typologies are difficult to estimate in a fragile state context, however as most of the considered projects chose to include green components in order to ensure long-term usage of the infrastructure, there may be long-term implicit cost savings associated with such projects. International climate finance can help fragile states secure the funds required to invest in these projects, however access to these funds may prove to be problematic for states which do not have good track records with good governance as is the case in a number of fragile states. The data provided in this report also shows that whilst there is a high availability of climate financing, the percentage that goes to fragile states is relatively low and the percentage that is destined to green infrastructure projects is even lower, hence fragile states seem to be limited in their capacity to access international financing mechanism.

How important is the role of governments for green infrastructure investments?

¹² Public-Private Infrastructure Advisory Facility

¹³ Private Infrastructure Development Group

Governments play a fundamental role in ensuring efficient and effective investments in green infrastructure such as ensuring that there is positive collaboration between different stakeholders where concerns about new infrastructure projects can be raised and resolved as well as engaging with stakeholders whose vested interests may be threatened (and could be opposed) to investments in green infrastructure. Whilst the role of government is fundamental in ensuring the success of green investments, such a factor is problematic in fragile states due to their relatively low levels of capacity and of governance capabilities. Such a lack of capacity makes the introduction of the correct policies and regulations problematic as well as limiting the ability of government to control corruption or reinforce relevant institutions as the needs arise in such a dynamic sector.

How can green infrastructure projects contribute to poverty reduction?

Green infrastructure can help reduce poverty in fragile states; the report has shown various examples where this has been achieved in different sectors of the economy, from benefits to households (such as the provision of LED lighting in rural areas) to improving the livelihoods of farmers (through more efficient irrigation systems that lead to increased agricultural yields) all of which are just as easily applicable to fragile states as they are to more stable states. The poverty reducing effects of green infrastructure investments can also be transmitted to other sectors of the economy which were not originally targeted by these investments. In the case of tourism, enhanced conservation efforts can lead to increased eco-tourism activities which in turn generate livelihoods (especially in poorer rural communities) and can be a source of further investments in green infrastructure as the conservation efforts are seen to generate further tangential economic activities.

What is the employment creation potential of green infrastructure projects?

There is a potential for employment creation from green infrastructure projects within a number of different sectors of the economy but the potential depends on varied conditions that fragile state governments may not be able to fulfil i.e. implementing correct labour market regulations or external factors such as the price of fossil fuels, factors that taken together will determine the extent of employment created by green infrastructure vis-à-vis other employment generating projects such as (non-green) transport infrastructure programmes that have a high employment creation potential.

What additional benefits do green infrastructure projects provide?

There are a number of different co-benefits that investments in green infrastructure can bring; these are applicable to any political, social or economic situation (including fragile or post-conflict states). The most important benefit that such investments will entail is a reduction of vulnerability to the negative effects of climate change, effects which would be magnified in a fragile state situation. Additional benefits include increased energy security as well as improved health outcomes i.e. through less air particle pollution as well as increased opportunities for female employment and female livelihood security.

Are green alternatives considered for green infrastructure projects in fragile states?

The limited review in this report has shown that where project appraisal data was available, green issues were indeed considered for infrastructure investments. The issue however is that these considerations are not framed in any type of comparison vis-à-vis non-green infrastructure alternatives, either in terms of cost, employment creation or any wider economic or social co-benefits. In addition, where green considerations were provided, they were mainly for projects that dealt specifically with the construction of green infrastructure. Where non green projects were carried out green considerations either tended to be discounted (though no basis was given for doing so) or were limited to environmental impact assessments.

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Annexes

Annex I: List of Fragile States (49 total) – Countries in **Bold** are also LDCs under UN classification (30).

World Bank Harmonised List of Fragile Situations 2013	Failed States Index (Top 35 - additional countries) to WB harmonised list
Afghanistan	Bangladesh
Angola	Cameroon
Burundi	Ethiopia
Bosnia & Herzegovina	Iran
Central African Republic	Kenya
Chad	Kyrgyzstan
Comoros	Malawi
DRC	Niger
Congo, Rep	Nigeria
Cote d'Ivoire	North Korea
Eritrea	Pakistan
Guinea	Rwanda
Guinea-Bissau	Sri Lanka
Haiti	Tajikistan
Iraq	Uganda
Kiribati	
Kosovo	
Liberia	
Libya	
Marshall Islands	
Micronesia	
Myanmar	
Nepal	
Sierra Leone	
Solomon Islands	
Somalia	
South Sudan	
Sudan	
Syria	
Timor-Leste	
Togo	
Tuvalu	
Yemen	
Zimbabwe	

Annex II: World Bank Ease of Doing Business Ranks for selected Fragile States

Country	Ease of Doing Business Rank 2009
Angola	168
Burundi	177
Cameroon	164
Central African Republic	180
Chad	175
Comoros	155
DRC	181
Congo, Rep.	178
Cote D'Ivoire	161
Eritrea	173
Ethiopia	116
Gambia	130
Guinea	171
Guinea-Bissau	179
Kenya	82
Liberia	157
Niger	172
Rwanda	139
Sierra Leone	156
Somalia	-
Sudan	147
Togo	163
Uganda	111
Zimbabwe	158

Source: ERD (2009)