Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy

Research results from the Potato Park and the Indigenous Peoples Biocultural Climate Change Assessment, Peru

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Summary

Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall strategy to help people to adapt to the adverse effects of climate change. Under the 'Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy' project, IIED, IUCN and the UN Environment World Conservation Monitoring Centre (UNEP-WCMC) are working at 13 sites in 12 countries to gather practical evidence and develop policy guidance for governments on how EbA can best be implemented. The project has developed a definition of effective EbA and a framework for assessing EbA effectiveness which has been applied at all 13 sites and the results will be collated and compared to draw conclusions that are based on more than single case studies. This report presents the findings from a literature review and two interviews on activities implemented at one of the two project sites in Peru, where a Potato Park has been created to protect the diversity of native potato varieties and other native Andean crops, and preserve indigenous biocultural heritage.

The report concludes that genetic diversity – especially agrobiodiversity when used in the context of food and agriculture – can provide a key ecosystem service for adaptation. Genetic diversity and the number of resilient potato varieties in the Potato Park have reduced the risk of crop failure from frost, drought and disease, which has improved resilience and adaptive capacity, and reduced vulnerability, among indigenous people, women and the poor in particular. The adoption of highly participatory and empowering participatory action research approaches was central to this. The park has also restored and enhanced ecosystem services, and these services are likely to be maintained over the long term. However, mining presents a possible threat to future project activities. The increase in income-generating capacity amongst communities in the park, and multiple broader economic benefits, suggest that the project has been cost-effective, and there is interest in replicating the model in other regions of Peru and other countries and indigenous communities globally.

Acronyms

ANDES	Asociación para la Naturaleza y el Desarrollo Sostenible
AVE	Adaptation, Vulnerability and Ecosystems project
BMUB	German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
CBD	Convention on Biological Diversity
CIP	The International Potato Centre
EbA	Ecosystem-based adaptation
IIED	International Institute for Environment and Development
IKI	International Climate Initiative
IPCCA	Indigenous Peoples' Biocultural Climate Change Assessment
IUCN	International Union for Conservation of Nature
MAG	Ministerio de Agricultura y Ganadería (Ministry of Agriculture and Livestock)
PES	Payments for ecosystem services
SDGs	Sustainable Development Goals
UNEP	United Nations Environment Programme
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
UNFCCC	United Nations Framework Convention on Climate Change

Introduction

The global climate is changing rapidly, and as nations and the international and bilateral organisations and processes that support them plan how best to adapt to climate change, they need evidence on where to focus adaptation efforts and direct financial resources accordingly. The main approach to climate change adaptation to date has tended to involve investment in engineered interventions, such as sea walls or irrigation infrastructure (Jones et al. 2012). There is growing realisation, however, that ecosystem-based adaptation (EbA) may sometimes provide the optimal adaptation solution, particularly for poorer countries where people are more dependent on natural resources for their lives and livelihoods. A growing number of organisations and countries are implementing EbA and integrating it into emerging climate change policy responses (Seddon et al. 2016a; 2016b).

EbA is defined by the United Nations Convention on Biological Diversity (CBD) as the "use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change as part of an overall adaptation strategy" (CBD 2009). This definition was later elaborated by the CBD to include "sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities" (CBD 2010). Examples of EbA include: restoring coastal ecosystems to lower the energy of tropical storms and protect local communities against erosion and wave damage; wetland and floodplain management to prevent floods and to maintain water flow and water quality in the face of changing rainfall patterns; conservation and restoration of forests and natural vegetation to stabilise slopes and prevent landslides, and to regulate water flows preventing flash flooding; and the establishment of diverse agroforestry systems to help maintain crop yields under changing climates. Box 1 describes some of the key attributes of effective EbA, derived from a review of relevant literature (taken from Seddon et al. 2016b).

Box 1: Key attributes of effective ecosystem-based approaches to adaptation (EbA)

1. **Human-centric.** EbA emphasises human adaptive capacity or resilience in the face of climate change.
2. **Harnesses the capacity of nature to support long-term human adaptation.** It involves maintaining ecosystem services by conserving, restoring or managing ecosystem structure and function, and reducing non-climate stressors. This requires an understanding of ecological complexity and how climate change will impact ecosystems and key ecosystem services.
3. **Draws on and validates traditional and local knowledge**. Humans have been using nature to buffer the effects of adverse climatic conditions for millennia. Traditional knowledge about how best to do this should thus be drawn upon when implementing EbA.
4. **Based on best available science**. An EbA project must explicitly address an observed or projected change in climate parameters, and as such should be based on climatic projections and relevant ecological data at suitable spatial and temporal scales.
5. **Can benefit the world's poorest**, many of whom rely heavily on local natural resources for their livelihoods.
6. **Community-based and incorporates human rights-based principles.** Like community-based adaptation (CBA), EbA should use participatory processes for project design and implementation. People should have the right to influence adaptation plans, policies and practices at all levels, and should be involved with both framing the problem and identifying solutions. EbA initiatives should be accountable to those they are meant to assist and not simply those providing support (ie donors or governments). EbA should consistently incorporate non-discrimination, equity, the special needs of the poor, vulnerable and marginalised groups, diversity, empowerment, accountability, transparency and active, free and meaningful participation.

7. **Involves cross-sectoral and intergovernmental collaboration.** Ecosystem boundaries rarely coincide with those of local or national governance. Moreover, ecosystems deliver services to diverse sectors. As such, EbA requires collaboration and coordination between multiple sectors (eg agriculture, water, energy, transport) and stakeholders. EbA can complement engineered approaches, for example combining dam construction with floodplain restoration to lessen floods.
8. **Operates at multiple geographical, social, planning and ecological scales**. EbA can be mainstreamed into government processes (eg national adaptation planning) or management (eg at the watershed level), provided that communities remain central to planning and action.
9. **Integrates decentralised flexible management structures** that enable adaptive management.
10. **Minimises trade-offs and maximises benefits with development and conservation goals** to avoid unintended negative social and environmental impacts. This includes avoiding maladaptation, whereby adaptation 'solutions' unintentionally reduce adaptive capacity.
11. **Provides opportunities for scaling up and mainstreaming** to ensure the benefits of adaptation actions are felt more widely and for the longer term.
12. **Involves longer-term 'transformational' change** to address new and unfamiliar climate change-related risks and the root causes of vulnerability, rather than simply coping with existing climate variability and 'climate-proofing' business-as-usual development.

Sources: Travers et al. (2012); Jeans et al. (2014); Faulkner et al. (2015); Reid (2014a); Reid (2014b); Girot et al. (2012); Ayers et al. (2012); Anderson (2014); Andrade et al. (2011); GEF (2012); ARCAB (2012); Bertram et al. (2017); Reid et al. (2009).

If properly implemented, EbA can meet objectives under all three Rio Conventions (Seddon et al. 2016b). For example, its emphasis on restoring natural ecosystems and increasing habitat connectivity helps countries meet their commitments under the Convention on Biological Diversity (CBD). EbA often involves maintaining the ability of natural ecosystems to control water cycles or supports effective management regimes for dry areas, and thus aligns with the goals of the United Nations Convention to Combat Desertification (UNCCD). Many EbA activities sequester carbon and some prevent the greenhouse gas emissions that would be emitted from hard infrastructure-based approaches to adaptation, thus helping meet mitigation targets under the United Nations Framework Convention on Climate Change (UNFCCC). EbA promotes sustainability across a range of sectors, including agriculture, forestry, energy and water, and as such could help countries meet their Sustainable Development Goals (SDGs) (Seddon et al. 2016b). Lastly, by increasing the resilience of vulnerable communities to extreme events such as flooding and landslides, EbA helps countries to meet the goals of the Sendai Framework for Disaster Risk Reduction (Renaud et al. 2013).

Despite its strong theoretical appeal, many positive anecdotes from around the world and the acknowledged multiplicity of co-benefits, EbA is not being widely or consistently implemented, or sufficiently mainstreamed into national and international policy processes. Relative to hard infrastructural options, EbA currently receives a small proportion of adaptation finance (Chong 2014) There are four major explanations for this (Biesbroek et al. 2013; Ojea 2015; Vignola et al. 2009; Vignola et al. 2013; Seddon et al. 2016b).

1. First, there is uncertainty around how best to finance EbA. International climate finance, through mechanisms such as the Green Climate Fund or the Adaptation Fund, is one possibility, but this will not provide enough to address adaptation challenges at the scale required to meet the needs of the world's poorest. Payments for ecosystem services (PES) is another possibility, and may provide an alternative source of funding, or large-scale government social protection, employment generation or environmental management programmes. However, in the context of providing finance for adaptation, both are in their infancy.
2. Second, many climate change impacts will be long-term, but this does not sit well with what are usually short-term political decision-making processes often based on standard electoral cycles. Photogenic engineered adaptation solutions with immediate but inflexible benefits are thus often

favoured over the long-term flexible solutions offered by EbA, under which benefits may only be apparent in the future.

3. Third, the evidence base for the effectiveness of EbA (especially its economic viability) is currently weak. Much evidence is anecdotal and comes from single case studies, and often the costs, challenges and negative outcomes of EbA activities are under-reported. More robust quantitative evidence, or at least consistently collated qualitative evidence, on the ecological, social and economic effectiveness of EbA projects relative to alternative approaches is needed (Doswald et al. 2014; Travers et al. 2012; Reid 2011; Reid 2014a; UNEP 2012).
4. The final major challenge to EbA relates to issues around governance. EbA necessitates cooperation and communication across multiple sectors and varying administrative or geographical scales. This is challenging for most models of governance, where decision making is often strongly based on sectors and administrative boundaries, and opportunities for supporting participation and locally driven approaches are limited.

Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy

The 'Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy' project was conceived to address the third (and fourth) challenge in the above list. The project aims to show climate change policymakers when and why EbA is effective: the conditions under which it works, and the benefits, costs and limitations of natural systems compared to options such as hard infrastructural approaches. It also aims to promote and provide tools to support the better integration of EbA principles into policy and planning. The project is supported by the International Climate Initiative (IKI). The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) supports IKI on the basis of a decision adopted by the German Bundestag. The project is being implemented by the International Institute for Environment and Development (IIED), the International Union for Conservation of Nature (IUCN) and the United Nations Environment World Conservation Monitoring Centre (UNEP-WCMC) in collaboration with 13 in-country partner organisations in 12 countries across Asia, Africa and the Americas (see Table 1). The project runs from July 2015 to September 2019.

Table 1: 'Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy' project countries, partners and case studies

Project partner country	In-country partner institution	Project case studies
China	Centre for Chinese Agricultural Policy, Chinese Academy of Science	Participatory plant breeding and community-supported agriculture in Southwest China
Nepal	IUCN	Ecosystem-based adaptation in mountain ecosystems programme (Nepal)
Bangladesh	Bangladesh Centre for Advanced Studies	Economic incentives to conserve hilsa fish in Bangladesh – a supportive research project to the Incentive-based hilsa fishery management programme of the Department of Fisheries
Kenya	Adaptation Consortium; Kenya Drought Management Authority	Adaptation Consortium – supporting counties in Kenya to mainstream climate change in development and access climate finance
South Africa	Conservation South Africa	Climate-resilient livestock production on communal lands: rehabilitation and improved management of dryland rangelands in the Succulent Karoo

Uganda	IUCN	Ecosystem-based adaptation in mountain ecosystems programme (Uganda)
Burkina Faso	IUCN	Helping local communities to prepare for and cope with climate change in Northern Burkina Faso
Senegal	IUCN	Ecosystems protecting infrastructure and communities (EPIC)
Peru	IUCN	Ecosystem-based adaptation in mountain ecosystems programme (Peru)
	ANDES	Indigenous people biocultural climate change assessment, Potato Park
Chile	IUCN	Ecosystems protecting infrastructure and communities, South America geographical component (EPIC Chile)
Costa Rica	IUCN	Livelihoods and adaptation to climate change of the Bri Bri indigenous communities in the transboundary basin of Sixaola, Costa Rica/Panama
El Salvador	IUCN	Mangrove ecosystem restoration and responsible fishing

In order to address the weak evidence base for EbA, the project has developed a definition of effective EbA and a framework for assessing EbA effectiveness. It defines effective EbA as “an intervention that has restored, maintained or enhanced the capacity of ecosystems to produce services. These services in turn enhance the wellbeing, adaptive capacity or resilience of humans, and reduce their vulnerability. The intervention also helps the ecosystem to withstand climate change impacts and other pressures” (Reid et al. 2017, based on Seddon et al. 2016b). This definition generates two overarching questions that need to be addressed in order to determine whether a particular EbA initiative is effective:

1. Did the initiative allow human communities to maintain or improve their adaptive capacity or resilience, and reduce their vulnerability, in the face of climate change, while enhancing co-benefits that promote wellbeing?
2. Did the initiative restore, maintain or enhance the capacity of ecosystems to continue to produce services for local communities, and allow ecosystems to withstand climate change impacts and other stressors?

By definition, EbA should also be financially and/or economically viable, and for benefits to materialise it needs support from local, regional and national governments and to be embedded in an enabling policy, institutional and legislative environment (Seddon et al. 2016b; Reid et al. 2017). This leads to two further overarching questions:

1. Is EbA cost-effective and economically viable?
2. What social, institutional and political issues influence the implementation of effective EbA initiatives and how might challenges best be overcome?

These questions encompass much important detail regarding how to assess and compare effectiveness in ecological, social and economic terms. They lead to a further set of nine more specific questions (Table 2) that reflect the growing consensus around the key characteristics of effective EbA (Box 1).

This framework is being applied in 13 project sites in 12 countries, and results from all sites will be collated and compared to draw conclusions that are based on more than single case studies and help answer the question of whether EbA is effective or not. Reid et al. (2017) provide detailed guidance on the way that researchers and project managers can use the framework to draw conclusions about the effectiveness of an EbA project, or to shape project design or assess the progress of an ongoing EbA project or a project that has ended.

Research conducted under the project will then be used to help climate change policymakers recognise when EbA is effective, and where appropriate integrate EbA principles into national and international climate adaptation policy and planning processes. An inventory of EbA tools and a 'tool navigator' are also being developed to support this process.

Table 2: Framework for assessing EbA effectiveness

1) Effectiveness for human societies *Did the initiative allow human communities to maintain or improve their adaptive capacity or resilience, and reduce their vulnerability, in the face of climate change, while enhancing co-benefits that promote long-term wellbeing?*
1. Did the EbA initiative improve the resilience and adaptive capacity of local communities, and help the most vulnerable (eg women, children and indigenous groups)? If so, over what time frames were these benefits felt, and were there trade-offs (or synergies) between different social groups? 2. Did any social co-benefits arise from the EbA initiative, and if so, how are they distributed and what are the trade-offs between different sectors of society? 3. What role in the EbA initiative did stakeholder engagement through participatory processes and indigenous knowledge play? Did/does the use of participatory processes support the implementation of EbA and build adaptive capacity?
2) Effectiveness for the ecosystem *Did the initiative restore, maintain or enhance the capacity of ecosystems to continue to produce adaptation services for local communities, and allow ecosystems to withstand climate change impacts and other stressors?*
1. What were/are the factors threatening the local ecosystem(s)? How did/do these pressures affect the resilience of the ecosystem(s) to climate change and other stressors and their capacity to deliver ecosystem services over the long-term? 2. After the EbA initiative, which ecosystem services were restored, maintained or enhanced, and did the resilience of the ecosystem change? Over what geographic scale(s) and time frame(s) were these effects felt, and were there trade-offs (or synergies) between the delivery of different ecosystem services at these different scales?
3) Financial and economic effectiveness *Is EbA cost-effective and economically viable over the long-term?*
1. What are the general economic costs and benefits of the EbA initiative? How cost-effective is it, ideally in comparison to other types of interventions, and are any financial or economic benefits sustainable over the long term?
4) Policy and institutional issues *What social, institutional and political issues influence the implementation of effective EbA initiatives and how might challenges best be overcome?*
1. What are the key policy, institutional and capacity barriers to, or opportunities for, implementing EbA at the local, regional and national levels over the long term? 2. What, if any, opportunities emerged for replication, scaling up or mainstreaming the EbA initiative or for influence over policy, and how? 3. What changes in local, regional and/or national government or in donor policies are required to implement more effective EbA initiatives?

The Potato Park and the 'Indigenous peoples biocultural climate change assessment'

The Potato Park is located in the Cusco Region of Peru, in the Pisac District of Calca Province. At altitudes ranging between 3,400 and 4,600 metres above sea level, it spans a territory of over 9,000 hectares. In its natural state, the ecosystem in this mountainous area in the Andes is categorised as subtropical moist broadleaf forests. However, it was largely deforested in colonial times. Established in 2000, the Potato Park works with six Quechua communities near Pisac and is being scaled out to a further 23 Quechua communities in the Lares District of Calca Province. The Potato Park is managed by indigenous communities rather than governments, and is governed collectively by a legally registered Association of Communities of the Potato Park, which has a communal land title. In addition to this governance body, it has a management body and a technical consultative body (Swiderska and INMIP 2017; Swiderska 2016a). Potato Park communities have developed an inter-community benefit-sharing agreement based on customary laws. This biocultural community protocol establishes claims to a range of rights in domestic and international law. The inter-community Potato Guardians group plays a key role in the stewardship of the park's potato diversity and collaborative research with scientists (Asociación ANDES and the Potato Park 2015). Whilst Potato Park activities are largely self-determined, outside agencies such as Oxfam-Novib, The Ford Foundation, the Christensen Fund, the United Nations University and IIED have provided support for its work and for scaling out the Potato Park model; see Reilly and Swiderska (2016) for details on the International Network of Mountain Indigenous Peoples learning exchanges, for example.

The park focuses on protecting and preserving the critical role and interdependency of indigenous biocultural heritage[1] for local rights, livelihoods, conservation and sustainable use of agrobiodiversity. Potatoes – now one of the world's major food crops – have been protected for centuries by the Quechua peoples' deeply rooted local food systems, and the Potato Park is located in a secondary centre of potato origin and a centre of potato diversity. It celebrates the tremendous diversity of native potato varieties, with around 650 different varieties (or more than 1,300 varieties according to traditional classification), along with other native Andean crops characteristic of Andean food systems. It is dedicated to safeguarding and enhancing these food systems and native agrobiodiversity using adaptive management of landscapes, ecosystems and biological and cultural assets, and holistic indigenous biocultural heritage area[2] approaches that are community-led and rights-based, and that link traditional and science-based knowledge of agricultural biodiversity. These approaches secure local livelihoods using the knowledge, traditions and philosophies of indigenous peoples. The park is concerned with indigenous peoples' self-determination and securing Quechua people's tenure and rights to agricultural biodiversity, local products, traditional knowledge, land and related ecosystem good and services.[3]

By sustaining diverse locally adapted crop varieties and ancestral knowledge about adaptation to climate change and resilient agroecological farming practices, the Potato Park supports adaptation by highland communities, which have already been significantly impacted by changes in climate. By sustaining evolving crop wild relatives and co-evolutionary processes whereby farmers select and improve local germplasm in extreme conditions, the park also provides a reservoir of resilient genetic resources for national and global adaptation and for maintaining future options.

With technical support from Asociación ANDES, the Potato Park is involved with the 'Indigenous peoples' biocultural climate change assessment' (IPCCA), which helps to assess climatic conditions and trends and their impacts on indigenous biocultural systems in order to develop appropriate adaptation responses (based on indigenous knowledge, agrobiodiversity and biocultural heritage) and empower indigenous communities. The assessment methodology brings together indigenous knowledge and cultural values and science to engage communities in developing evidence-based

[1] Biocultural heritage refers to the knowledge and practices of indigenous people and their biological resources, from the genetic varieties of crops they develop, to the landscapes they create.
[2] Biocultural heritage areas or Territories refer to land use mosaics encompassing indigenous and traditional land tenure, production and exchange systems, cultural identity, community organisation and simultaneous goals of endogenous development and biodiversity conservation.
[3] http://www.parquedelapapa.org/eng/03parke_01.html

responses in the form of local adaptation plans called 'life plans'. These life plans are a way of formalising and prioritising particular aspects of local development and food security that contribute to adaptation. They provide a framework for implementing climate change response strategies using an ecosystem-based approach, which integrates ecosystems and development and is also based on local knowledge and culture, and therefore nurtures resilient food and agriculture systems in the mountain ecosystem. The IPCCA process informs policy development and supports the implementation of multilateral environmental agreements, thus linking local biocultural realities with complex global processes. The IPCCA is an international initiative with similar projects implemented in China, Thailand, the Philippines, Finland, Ecuador, Kenya, the United States, Panama and India.

Genuine ecosystem-based adaptation initiatives must meet the following four criteria (Martin 2016; CBD 2009; CBD 2010): they must use biodiversity and ecosystem services; they must help people; they must support human adaptation to the adverse effects of climate change; and they must form part of an overall strategy. The Potato Park was not designed as an EbA intervention and addressing climate change is not one of its primary stated aims, and yet it has proved vital for adaptation to climate change (Swiderska 2016b) and clearly meets all of these criteria.

Methodology for assessing effectiveness

The methodology for assessing EbA effectiveness applied to most case studies under the 'Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy' project is detailed in Reid et al. (2017). This guidance describes a process, based around asking a detailed set of questions, that can be used to draw conclusions about the effectiveness of an EbA project that is ongoing or has ended. The methodology details a set of questions that stakeholders from a variety of levels are requested to answer (the national level, local authority level, project implementers and community beneficiaries). It was not possible to conduct interviews with all stakeholder levels in the Potato Park, and this paper summarises the results of an interview with Alejandro Agumedo of ANDES and a questionnaire completed by Krystyna Swiderska of IIED. With only two people answering questions, a smaller range of views have been collected compared to other case studies, and confidence in the results described below is therefore lower.

Relevant publications were also reviewed to assess the characteristics of Potato Park activities that contribute to EbA effectiveness. The results of this assessment are described in the following results section.

Research results

Effectiveness for human societies: did the initiative allow human communities to maintain or improve their adaptive capacity or resilience, and reduce their vulnerability in the face of climate change, while enhancing co-benefits that promote long-term wellbeing?

Did the EbA initiative improve the resilience and adaptive capacity of local communities, and help reduce vulnerability?

Resilience and adaptive capacity were improved, and vulnerability reduced, as a result of Potato Park activities. Examples of this include:

- **Increases in genetic diversity and the number of resilient varieties have reduced the risk of crop failure from frost, drought and disease** in two ways: first, through diversification which reduces risk to various different stressors in the face of growing climate variability (some farmers plant as many as 200 different potato varieties); second, by planting varieties that are resilient to particular stressors. The park now has 18 potato varieties with high tolerance to frost and drought, and one virus-tolerant variety (Swiderska and INMIP 2017). A repatriation agreement with the International Potato Centre (CIP) returned 410 locally adapted potato varieties, which had been collected from the area in the 1960s and 1970s, thus increasing the number of potato varieties from

roughly 200 to 650. Repatriation of other Andean tubers has also occurred. Potato diversity in the park increased from around 600 different types in 2000 to around 1,344 in 2014, of which about 650 are scientifically distinct varieties (Asociación ANDES and the Potato Park 2015). Potato yields have increased slightly since 2002 despite severe climate change impacts (Asociación ANDES 2016), although some of this yield increase may also be because varieties returned are disease-free. Higher diversity also provides options for longer-term adaptation, facilitated by the community seedbank.

- ***Local capacity for research and confidence in traditional knowledge has increased*** as a result of the highly participatory and empowering participatory action research approach supported by ANDES. This has enabled indigenous farmers to act as co-researchers with CIP. Community researchers now monitor various climatic parameters, monitor their impact (through potato transects), produce botanical (disease free) seeds, and multiply, test and distribute these for adaptation (Swiderska and INMIP 2017).
- ***Strengthened Andean cultural values and identity, and stronger social cohesion, have contributed to adaptation*** by helping to sustain resilient ecosystems and high levels of resilient agrobiodiversity, and by promoting social equity and inclusion so that the adaptation needs of the most vulnerable are addressed. The adoption of participatory action research approaches has contributed to this process and helped establish collective institutions for natural resource management.
- ***Collective institutions and decision making contribute to adaptive capacity*** through the exchange of knowledge, innovations and seeds. For example, the Association of Communities of the Potato Park ensures the sustainable management of ecosystems and agrobiodiversity. The pooling of land makes it easier to experiment and identify different micro-climates in which potatoes can grow as global warming has pushed the lower planting line for potatoes up to about 4,500 metres, above which there is little cultivatable land. The Seed Guardians group ensures the conservation and improvement of agrobiodiversity for climate adaptation. The biocultural heritage territory model for Potato Park management is central to developing an adaptive strategy that helps communities cope with climate change. Economic collectives provide the business model for microenterprises in the park that also contribute to sustainable resource management. This model fosters innovation and reduces risk (Asociación ANDES and the Potato Park 2015).
- ***Vulnerability to crop failure from pests, frost, diseases, erratic rainfall, and so on has been reduced***. Traditional knowledge on ecosystems and agrobiodiversity has informed the park's integrated management plan. This includes knowledge on rainfall frequency, wildlife breeding grounds, pests, and so on, and also on traditional farming practices which spread risk across space and time. For example, planting a high number of potato varieties together is an ancestral strategy to reduce the risk of crop failure (Asociación ANDES 2016). This has reduced climate change risks. Shifting the altitudinal range at which potatoes (and other crops) are cultivated helps avoid yield reduction as a result of the effects of climate change on temperatures, pest prevalence and water availability. Farmers have been practicing this strategy for over 25 years, but it has renewed importance in the context of climate change (Asociación ANDES and the Potato Park 2015).
- ***Linking scientific and indigenous knowledge has helped strengthen adaptive capacity.*** For example, information from NASA's Landsat satellite images is combined with information from local weather stations. Traditional knowledge is used to monitor changes in climate and weather. Experimental transects to monitor climatic impacts on potato production are designed and assessed using complementary scientific and traditional knowledge for improved overall understanding. Net houses, introduced by CIP, help Quechua farmers keep out disease vectors while mini-tuber seeds are cultivated, and ancestral weather forecasting informs reservoir construction to improve water availability. The Potato Park collection is stored both *in situ* (in the park) and *ex situ* (with CIP), which fosters collaboration between communities and scientists, leading to enhanced capacity and understanding in the face of climate change (Asociación ANDES and the Potato Park 2015).
- ***Knowledge has been enhanced.*** The Seed Guardians group has received training in botanical seed production, transects, seed multiplication, and so on, which has significantly enhanced the scientific knowledge of communities. The knowledge of scientists has also improved, for example through the wider repatriation of native varieties using respectful and mutually beneficial

partnerships with indigenous communities. A review conducted by the Consultative Group on International Agricultural Research's 'Research Program on climate change, agriculture and food security' found that the Potato Park-ANDES-CIP repatriation agreement has had significant social learning impacts for both communities and scientists (Stenner et al. 2016).

- ***Access to information has improved***. For example, local radio stations share information on extreme events. Climate-resilient varieties and associated knowledge and practices are also shared amongst farming communities. The open-source 'Khipu' biocultural heritage register documents pooled knowledge from park communities, which is useful for improving productivity in the face of climate change (Asociación ANDES and the Potato Park 2015).
- ***Livelihoods have improved, crops have diversified and the economy has also diversified***, thus strengthening resilience. Economic diversification into educational ecotourism has boosted resilience. Improved organic farming techniques relating to the production of locally made natural fertilizers and pesticides are now used (Asociación ANDES and the Potato Park 2015).

Which particular social groups experienced changes in resilience, adaptive capacity or vulnerability as a result of the initiative?

The Potato Park targets **indigenous peoples**, originally six Quechua communities but now five as one has dropped out of the Potato Park association. These high Andean farmers are some of the poorest and undernourished people in Peru, and are particularly vulnerable to climate change (Sietz et al. 2012). The biocultural heritage area approach builds on local knowledge and addresses the fact that much of the information available is not in Spanish and is not based on local people's own heritage.

Amongst these Quechua communities, **women** have been a key target. They are the main actors in various economic collectives (focusing on gastronomy, crafts and natural products), which generate additional income, and they form much of the traditional agricultural labour force, allowing their husbands to look for temporary work in Cusco or nearby cities (Asociación ANDES and the Potato Park 2015). Because most microenterprises are managed by women, any training or financial skills enhancement provided tends to benefit women more. The biocultural heritage area approach emphasises women too. Women are the traditional seed guardians in Peru (Reilly and Swiderska 2016), and activities relating to seeds and agrobiodiversity highlight women's knowledge and practices, while activity outcomes are designed to be useful for women. The park has a framework for gender planning and data gathering, and gender issues are discussed within a culturally sensitive environment and following local principles and protocols.

Potato Park communities live below the national poverty line, with high food insecurity, high illiteracy particularly amongst women, and very poor agricultural extension, training and financial services (Asociación ANDES and the Potato Park 2015). An inter-community benefit-sharing agreement prioritises equitable benefit sharing and ensures that 10% of the profits from each micro-enterprise are invested in a communal fund. This fund is shared equitably amongst the communities at the end of each year, according to agreed rules based on customary laws. Once the benefits have been distributed to communities, the surplus is shared with **the poorest and most vulnerable** community members, such as widows and orphans, which provides them with a social safety net (ANDES et al. 2011).

Some **elders** are members of the Potato Guardians group who manage the repatriated varieties and act as 'technicians' or co-researchers (who are paid by ANDES). Efforts are also made to engage **youth** in the Potato Park activities, for example through knowledge transfer activities, revival of traditional festivals and development of micro-enterprises. Bringing elders and youth together is important for inter-generational transmission of indigenous knowledge for EbA.

Trade-offs in terms of who *experiences changes in resilience, adaptive capacity or vulnerability,* where *changes occur and* when

There were no trade-offs in terms of *who* experiences changes in resilience, adaptive capacity or vulnerability. Communities have systems to manage decision-making and the exchange of experiences, and these have been strengthened under the project. These systems minimise trade-offs. Community-

led biocultural approaches fully integrate the livelihood concerns of local people alongside environmental and adaptation objectives, while also contributing to national and global public goods (such as biodiversity and water provision) and adaptive capacity. Engaging different communities in a landscape and emphasising inclusive processes and core cultural values relating to equity, solidarity and sharing ensures costs and benefits are distributed equitably.

There were no trade-offs in terms of *where* changes in resilience, adaptive capacity or vulnerability occur. Rather, adaptation benefits spread to neighbouring communities as the Potato Park farmers share and distribute resilient seeds. Adopting a landscape-based approach that provides a range of goods and services helps avoid trade-offs.

There were no trade-offs in terms of *when* changes in resilience, adaptive capacity or vulnerability occur. Diversification reduces crop failure in both the short and long term, whereas modern varieties and monocultures are unlikely to survive the harsh and variable high altitude climate and would contribute to genetic erosion, reducing adaptive capacity in the long term. Improvements to resilience are long-term – they can last hundreds of years provided strong local institutions are in place – but it can take time to build such lasting institutions, perhaps five to ten years.

Social co-benefits from the EbA initiative

The Potato Park has generated considerable social and cultural benefits, many of which also contribute indirectly to climate change adaptation:

- **Cultural, territorial and biodiversity-related benefits**. Communities value these more than an increase in their income. Strengthening Andean cultural values – such as equilibrium, reciprocity and solidarity – has served to strengthen the core ecological and social values embedded in them. According to the Andean *ayllu* concept, which guides the Potato Park, achieving wellbeing requires a balance between the human/domesticated, the sacred and the wild 'realms' (thus helping to conserve wildlife as well as agrobiodiversity). The Potato Park has a rich culinary heritage, protected by a 'culinary sanctuary,' and with a restaurant dedicated to the native potato. There is now a National Day of the Potato in Peru, and new biocultural festivals based on local traditions have been established (Asociación ANDES and the Potato Park 2015). These activities generate cultural as well as economic incentives to sustain potato diversity.
- **Livelihood provision/diversification**. Ecotourism provides the highest source of income (ANDES et al. 2011). Other economic collectives include gastronomy, handicrafts and natural products (such as herbal teas and creams, and potato shampoo). These economic collectives ensure the economic viability and continuation of biodiverse agroecological traditional farming systems, and generate direct use incentives for the conservation of ecosystems and their services (such as medicinal plants). Improved use of information and communication technologies has increased market access for these products and services.
- **Food security and health.** Indigenous farmers have more food and more seeds, and health benefits from more nutritious food. High-altitude purple potatoes have high levels of anti-oxidants which can be used to help address child nutrition problems and may have anti-cancer properties (Swiderska and INMIP 2017; Reilly and Swiderska 2016). Sustainable water provision has improved, along with improved access to water from high-altitude lakes.
- **Improved security and reduced conflict over resources**. Before the work by ANDES began, there were serious conflicts over resources between communities. Such conflicts no longer occur as competition for resources has been replaced by collaborative management.
- **Improved social cohesiveness** between communities. This has been built by emphasising shared cultural identity and values, which enables effective collective management of ecosystems and agrobiodiversity. Establishing collective institutions has led to more exchange of knowledge, innovations and seeds between communities, and has thus improved food security. Building bottom-up alliances using participatory processes has created sustainable local institutions.
- **Strong local institutions, policies and governance**. New, bottom-up inter-community governance structures have been created and regulation has been introduced to enforce local customary laws at

a landscape level, notably through the inter-community agreement. This has resulted in good communal land management and improved decision making (Swiderska and INMIP 2017).

- **Climate change mitigation** in the Andean pastures as a result of the maintenance of traditional grazing practices and highland pasture management which stores carbon.
- **Disaster risk reduction** in the context of reduced risk of crop failure. Improvements in communal land management and enhanced crop diversity have led to disaster risk reduction. Keeping an 'adaptation calendar' forms part of this. Reforestation around roads has helped reduce landslide risks.
- **Networking and new alliances** formed with government and external experts, for example at CIP and staff at ANDES. This has helped strengthen communities' influence on policy development.

Distribution and trade-offs relating to social co-benefits

No social groups benefitted more from these co-benefits than others.

The role of participatory processes and local/indigenous knowledge

Indigenous knowledge and highly participatory action research have been key to the success of the Potato Park and central to increasing adaptive capacity. Crop diversification, for example, is an ancestral strategy to reduce risk. Embedding the work in local culture has been central for ensuring strong local ownership and sustainability, and participatory processes are the key to ensuring the Potato Park work is effective. Swiderska (2016b) details how the highly participatory action research methodology used by ANDES has strengthened social cohesion and built the capacity of indigenous farmers to conduct collaborative research directly with CIP scientists. The approach has empowered farmers by recognising the vital importance of their traditional knowledge and placing equal value on traditional knowledge and science. Conceptual frameworks for research are guided by indigenous Quechua concepts, and indigenous research methods and tools are used and combined with modern participatory approaches. Farmers in the park now continually select for resilience traits, including drought, frost and pest resistance, using both indigenous knowledge and science.

Participation can be characterised primarily as 'self-mobilisation' or 'interactive' from the typology supplied.[4] The Potato Park uses a community-led self-mobilisation approach throughout its activities as follows:

- The Potato Park biocultural heritage territory model is unlike a 'national park' because it is run by the communities instead of governments, on the basis of customary laws. This community-led model of territorial management enables 'self-determination'. The Association of Communities of the Potato Park was established using existing community structures and processes, and the communities themselves defined its structure and operations (Asociación ANDES and the Potato Park 2015).
- Decisions are made by community institutions. Any project needs to be approved by communities through a free prior and informed consent process. Projects must also ensure communities play a leading role in project design, facilitation, data collection and analysis.
- Projects are implemented by community technical experts, with ANDES providing technical support. Community technical experts are elected by the community authority.

[4] Participatory approaches can be characterised according to the following typology: (1) passive, where people are told what is going to happen or has already happened; (2) information giving, where people answer questions posed by extractive researchers (they cannot influence proceedings and research findings may not be shared with them); (3) consultation by external professionals who define both problems and solutions (decision-making is not shared, and professionals are under no obligation to take on board people's views); (4) for material incentives, where people provide resources, for example labour, in return for food, cash or other material incentives; (5) functional, where people form groups to meet predetermined objectives related to the project. Such involvement tends to be during later project cycle stages after major decisions have been made; (6) interactive, where people participate in joint analysis, which leads to action plans and the formation of new local institutions or the strengthening of existing ones (groups take control over local decisions so people have a stake in maintaining emerging structures or practices); and (7) self-mobilisation, where people take initiatives independent of external institutions, develop contacts with external institutions for the resources and technical advice they need, but retain control over how resources are used. Adapted from Adnan et al. (1992) and Dazé et al. (2009).

- The approach emphasises horizontal learning and knowledge exchange with other communities, where the Potato Park farmers provide training directly to other farming communities to scale out successful innovations for adaptation (Swiderska and INMIP 2017).

Research conducted as part of IIED's 'Smallholder innovation for resilience' project found that many of the technological innovations developed in response to climate change and other socioeconomic challenges faced by Potato Park communities were developed endogenously by community members and transmitted from farmer to farmer (Asociación ANDES and the Potato Park 2015; Asociación ANDES 2016). Elders – who are recognised and respected in their communities – and women are considered key to developing and sharing these innovations. For example, new ploughing techniques for potato cultivation, based on traditional practices, have now been adopted. On the other hand, most of the market and institutional innovations developed to address the above challenges were developed collaboratively by community groups working with innovative outside institutions such as ANDES and CIP. Community assemblies are important for sharing knowledge, group decision making and problem solving. Intercommunity groups have supported innovation by bringing together like-minded people to solve problems. Participation in networks and events can support wider dissemination of innovations to farmers, policymakers and scientists.

Effectiveness for the ecosystem: did the initiative restore, maintain or enhance the capacity of ecosystems to continue to produce ecosystem services for local communities, and allow ecosystems to withstand climate change impacts and other stressors?

Factors threatening local ecosystem resilience and service provision

- Climate change has led to increased temperatures and higher temperature extremes, more erratic rainfall, and reduced growing season length in the Potato Park (Asociación ANDES, 2016). The lower planting line for potatoes has moved up by 200 metres in the last 30 years due to increases in soil pests as a result of warming (Stenner et al. 2016), and people now grow potatoes at 4,500 metres, the highest in the world, because of climate change (Swiderska and INMIP 2017). All of these have contributed to reduced productivity. Climate change has forced some potatoes to the top of the mountain because they can no longer grow at lower altitudes due to soil warming and pests, so some varieties are now at risk of extinction as they have reached the mountain top. Interviews with Potato Park farmers under the 'Smallholder innovation for resilience' project detail how they have identified three climate change-related threats: erratic weather, warming temperatures, and late and unpredictable rains which have resulted in a shorter growing season. These changes have reduced the number of potato varieties they can grow, and the resulting yield. Increased temperatures and erratic weather have increased pests and diseases such as late blight, potato tuber moth and Andean potato weevil (Asociación ANDES and the Potato Park 2015; Asociación ANDES 2016). Reilly and Swiderska (2016) also detail how the numbers and size of glaciers and glacial lakes is decreasing due to climate change, and how this is affecting water availability.
- As people move up the mountain due to global warming, they convert land to farming land, but less land is available (if you consider mountains as cones with less surface area at higher altitudes) so overexploitation occurs. Invasive species and diseases then follow.
- The government of Peru favours mining and the introduction of export-oriented crop species. High-level corruption and certain legal and policy instruments make it difficult for communities to manage their land at times.
- Genetic erosion has exposed farmers to a higher risk of crop failure. Reduced genetic diversity reduces the ability of agroecosystems to adapt to change. Genetic diversity is the product of both people and ecosystems, not just of ecosystems, and the erosion of peoples' knowledge and traditional farming systems due to modernisation and agricultural subsidies contributes to genetic erosion.

Boundaries influencing ecosystem resilience

Management at the landscape level (ie beyond the scale of a single village) can sustain higher genetic diversity and wild relatives, and also support gene flow, which is important for adaptation (for example, between communities at different altitudes and between wild relatives and domesticated crops). Pooling of land in the Potato Park also allows communities to test crops in different parts of the landscape and in different micro-climates and to expose them to particular selection pressures. This can speed up the process of evolution, which supports adaptation (Swiderska 2016b). Wild relatives of crops are a key source of resilient genes, but the minimum size needed to ensure these survive is uncertain. The watershed is a key level for management, and the biocultural landscape approach acknowledges this and includes rivers. The intention is to align landscape-level boundaries with management and administrative boundaries based on cultural norms, and this is made possible because the indigenous territory includes production systems as well as organisational units.

Thresholds influencing ecosystem service provision

With 2˚C of warming, the local glaciers will disappear; high-altitude species will also disappear. Warming of 1.5˚C could be accommodated, but 2˚C would be disastrous. This is therefore a critical threshold. Simulations based on climate change projections for 2050 and 2080 by Vuille et al. (2008) indicate that glaciers will continue to retreat, and that many smaller, low-lying glaciers are already completely out of equilibrium with current climate and will disappear within a few decades. In catchments where glaciers do not completely disappear, the change in streamflow seasonality, due to glacial melting, will significantly affect downstream water availability (Vuille et al. 2008). Urrutia and Vuille (2009) add that the tropical Andes also play a critical role for downstream water supply (for domestic, agricultural or industrial use) by retaining much of the high-elevation precipitation as ice in mountain glaciers before gradually releasing it over time. This environmental service is often taken for granted, but projections indicate that it is threatened by climate change (Urrutia and Vuille 2009).

There may be a minimum threshold of diversity needed to withstand certain levels of variability.

EbA initiative impacts on ecosystem resilience and services provision

Resilience improved and ecosystem services in the following categories were maintained, restored or enhanced as a result of the Potato Park:

- **Provisioning services** such as food and water. Crop diversity has been reintroduced and water channels constructed to fill small lakes and dams for water harvesting. Genetic diversity was restored, leading to more resilient agroecosystems. The Potato Park also sustains medicinal plants which provide health benefits. Ecosystem restoration occurred, such as the reforestation of native forests.
- **Cultural services** such as spiritual, aesthetic, recreational or educational services. Restoration of traditional crops has revived associated traditional knowledge, rituals and spiritual values, contributing to enhanced social capital and social cohesion and also enhancing cultural incentives for conservation and EbA.
- **Regulating and supporting services**. Terracing has improved the soil quality and reduced soil erosion, and has improved the microclimate and nutrient cycling (and enhanced ecotourism). The Potato Park has also enabled the continuation of the traditional rotational system whereby high-altitude potato cultivation moves from site to site or community to community every seven years to allow for a seven-year fallow period to let the land recover.

Geographic scale of ecosystem services provision and trade-offs or synergies between geographical scales

Ecosystem services were maintained, restored or enhanced at the level of the mountainous region. This covers an area of roughly 9,000 hectares in the high Andes, and includes five or six dispersed villages. This is also a watershed providing water from the glaciers for Cusco.

There were no trade-offs between the delivery of different ecosystem services at different geographical scales.

Time frame over which ecosystem services are provided, and trade-offs or synergies between timescales

Ecosystem services are expected to be maintained over the long term, for well beyond ten years. The community seedbank, for example, has a long-term vision (Asociación ANDES and the Potato Park 2015). It took about two years to bring the communities together and establish the collective Potato Park association for managing the Potato Park's ecosystems and agrobiodiversity. It took about five years to establish the repatriation agreement with CIP. And it took five to ten years of investment in participatory processes to build strong self-sustaining community institutions, management systems and capacity (for income generation, scientific research and policy engagement), but this will generate impacts far into the future. It is clear that the communities feel strong ownership and pride in *their* park and in their biocultural heritage, which is linked to their identity as descendants of the Incas. Genetic diversity is part of this biocultural heritage.

There were no trade-offs between the delivery of different ecosystem services at different timescales. The land had been largely deforested in colonial times, and the project only worked in areas that had been cultivated.

Financial effectiveness: is EbA cost-effective and economically viable over the long term?

How cost-effective is the EbA initiative?

No formal cost-benefit analysis has been conducted, although there is some evidence that the Potato Park is cost-effective thanks to the increase in income-generating capacity amongst communities. However, benefits such as increased capacity, social capital and cohesion are hard to quantify. Placing a monetary value on ecosystem restoration is difficult, and standard cost-benefit analysis tends to ignore indigenous valuation methods and priorities, with questions framed inappropriately. For example, exchange through bartering often outweighs monetary exchanges, but few standard cost-benefit studies capture this. Asociación ANDES and the Potato Park (2015) describes how bartering nurtures a strong sense of interdependence amongst the communities and is fostering reciprocity.

How did the EbA approach compare to other types of intervention?

The Potato Park approach has not been compared to any other adaptation interventions.

Broader economic costs and benefits from the EbA initiative

Broader economic benefits from the Potato Park include:

- Avoided losses from disasters. Landslides are less likely, for example.
- Local income enhancement. Income from micro-enterprises is rising, especially for women. A traditional restaurant and artisanal craft centre have become an important source of income (Reilly and Swiderska 2016). Higher potato diversity has also contributed to the rise in incomes through the use of repatriated varieties and through tourism. Biomass production has increased, as has the value of ecosystem services. Tourists and educational visitors are attracted by the innovative repatriation agreement. Agro-ecotourism is the biggest source of income, and incomes nearly doubled between 2002 and 2012 thanks largely to this tourism and the park's economic collectives (ANDES 2016).
- An economic value for land ownership and land rights in the Potato Park.
- A likely increase in land value.

- Bartering – the exchange of goods and services – which provides a safety net in case of climate-related problems with food production or boom-and-bust cycles of tourism (Asociación ANDES and the Potato Park 2015).

While the government of Peru, including the environment and culture ministries, have been very supportive of the Potato Park and recognise its value for food security and tourism revenue, other sectors of the government might argue that there are also opportunity costs, for example from lost mining opportunities.

Financial and economic trade-offs at different geographical scales

There were no financial or economic trade-offs between management at different geographical scales. Diversity is fostered, and management approaches minimise losses. Although management at the landscape level has some cost and time implications, it also brings opportunities to generate additional income from landscape-based goods and services (medicinal plants, tourism, etc), which outweigh the costs.

Changing financial and economic benefits and costs over time

Average household incomes in the Potato Park have increased over time, almost doubling between 2002 and 2012 despite severe climate change impacts (Swiderska 2016a). Investments of time and money into Potato Park management have been considerable for more than ten years, but these will lead to sustained economic benefits. As with the social and ecological benefits, it has taken five to ten years for economic benefits to materialise, in part because of the high altitude and remote location which mean change is slow, but these benefits will be sustained over the long term. Value chains for landscape-based products and services are also more secure now.

Policy and institutional issues: what social, institutional and political issues influence the implementation of effective EbA initiatives and how might challenges best be overcome?

Local-level barriers to implementing EbA

The following local-level barriers to implementing the Potato Park initiative were experienced:

- The loss of many of the Incas' sustainability and ecological land management skills over the years.
- Insufficient knowledge at the government level on ecosystem-based approaches.
- A lack of technical skills at the local government levels. These skills exist at the local level, but have not been institutionalised within government.
- Unsupportive government policy and legal framework. Decentralisation is minimal so there insufficient implementation of supportive regional policies at the local government level.
- Lack of coordination between policies.
- Low donor/government priority at the local level.
- Weak collective community-level institutions, which were particularly challenging at the start of the project.
- Weak representation and participation of indigenous peoples in decision making. Government sees the communities as 'clients' rather than partners, and there is still considerable racism towards indigenous people.

Regional-level barriers to implementing EbA

The following regional-level barriers to implementing the Potato Park initiative were experienced:

- Insufficient cross-sectoral institutional or inter-ministerial collaboration.

- Weak or no collaborative cross-sectoral legal and policy frameworks. Indigenous life plans (supported by the Ministry of Culture) need to be linked to regional development planning.
- Low government priority. The regional government receives taxes from mining companies, and corruption is problematic.
- Insufficient implementation capacity, and the challenges of working with communities at the regional level.

National-level barriers to implementing EbA

The following national level barriers to implementing the Potato Park initiative were experienced:

- Insufficient cross-sectoral institutional or inter-ministerial collaboration, and weak collaborative cross-sectoral legal frameworks. Further integration of traditional knowledge and culture and biocultural heritage across different laws, programmes and projects relating to education, agriculture and economic development is needed. Collaboration with the Ministry of Culture is insufficient. Ministers compete against each other and often oppose each other in their desire to secure hegemony over Potato Park activities and to recognise it within their structures and policies, which has implications for the local level. The Potato Park would rather see collaboration and support from all government sectors.
- Unsupportive government policy and legal framework. This creates external threats and risks, for example through the promotion of intensive agriculture, and the threat of biopiracy, genetically modified crops and mining. The rights of indigenous communities over the resources under the soil are not recognised. Bureaucratic hurdles prevented the Potato Park from formally registering its trademark to gain legal intellectual property rights protection (Swiderska 2016a). Biocultural heritage landscapes are not currently legally recognised and have no formal designation within the national protected area system, for example (Swiderska 2016a). There is also little decentralisation to the local government or community level in Peru.
- Low government priority. Implementation of the Law on Agrobiodiversity Zones is needed. This is a key opportunity to obtain stronger legal recognition and protection of the Potato Park (in addition to communal land title, which may not be sufficient to prevent mining).
- Weak land governance. The Peruvian government favours mining and corruption is endemic. Common property rights are weakened and eroded, and there is conflict over water and mining. The legal and policy environment erodes good land management. Political paralysis can hinder progress towards legal recognition of community-led biocultural heritage areas or EbA initiatives like the Potato Park.
- Low donor priority. More support for agrobiodiversity-based and community-led EbA is needed. EBA is a marginal issue – there is no mandate for it. Most EbA donors do not perceive agrobiodiversity, community leadership and indigenous knowledge as important.
- The educational system in Peru does not give the right technical skills for such projects.
- Insufficient implementation capacity, and the challenges of working with communities at the national level.
- Government official turnover. National elections in May 2017, for example, led to a change in government and the end of hard-earned relationship building.

Local-level opportunities for implementing EbA

The following local-level opportunities for implementing the Potato Park initiative were experienced:

- Project ‘champions’ – namely, ANDES, local researchers (both male and female), Potato Guardians and local institutions. Key public figures who can promote the Potato Park and push for legislative change have been important. The potato itself is also a ‘champion,’ being such a charismatic species. A flagship species, good branding and an emblematic project have also helped raise the profile of the Potato Park.

- Appropriate incentives in place to motivate action, including collective land tenure and access to markets for selling biocultural heritage products (Asociación ANDES and the Potato Park 2015).
- Strong local institutions, such as the establishment of a collective Potato Park association (legally registered as a private association/NGO) which formalised the collective governance system and enabled the Potato Park to enter into a formal agreement with CIP for repatriation. A Potato Park water committee manages water resources (Reilly and Swiderska 2016).
- Technical support, training and access to resources for community innovation (Asociación ANDES and the Potato Park 2015).

Regional-level opportunities for implementing EbA

The following regional-level opportunities for implementing the Potato Park initiative were experienced:

- Supportive regional policy/legislation (in some arenas). Thanks to advocacy work by ANDES, once the Potato Park had been established, the regional government passed a law against biopiracy and a law banning genetically modified organisms in the Cusco Region.
- Trademarking and labelling ecological approaches to conservation and development, which have helped with 'branding' and incentivising change. The Potato Park has developed its own trademark system and policy, which operates informally (Asociación ANDES and the Potato Park 2015; Argumedo 2013).
- Support for, and visits to, the Potato Park by regional government staff.
- Cooperation with research centres and universities to develop methods to innovate jointly (Asociación ANDES and the Potato Park 2015).

National-level opportunities for implementing EbA

The following national-level opportunities for implementing the Potato Park initiative were experienced:

- Supportive national policy/ legislation (in some arenas). Whilst not all policies are supportive, there are a number of policies and policy frameworks which are geared towards recognising, promoting and protecting biocultural heritage in Andean communities in Peru. (for example, government policy recognises indigenous land rights). Similarly, a national law to protect traditional knowledge is in place, and there is legislation for the conservation and sustainable use of biological diversity. In December 2016, the government of Peru approved a new law on agrobiodiversity zones which aims to promote the conservation and sustainable use of native species cultivated by indigenous peoples in Andean landscapes. The new law encourages local and sub-national authorities (regional governments) to implement agrobiodiversity zones and to adopt measures for the conservation and sustainable use of biological diversity and the prioritisation of conservation actions on ecosystems, species and genes, privileging those with high ecological, economic, social and cultural value. This provides a key opportunity to enhance legal protection for local rights, which is important as land title is not enough to protect the Potato Park from mining.
- Government support. The Ministry of Culture and the Ministry of Environment are very supportive.
- Improved collaboration between ministries. ANDES has also been working to bring together ministers to address the challenges of insufficient cross-sectoral institutional support. Links between environment, tourism, culture and agriculture ministries have been strengthened as a result of the project. The Vice President of Peru and the Minister of Environment visited the Potato Park in 2017. The Vice President expressed support for collaboration between ministries, although it is unclear how to capitalise on her visit is.
- International exposure and engagement around the Potato Park, which has helped the government of Peru feel included, which in turn elicits support. For example, the Vice President has talked about the Potato Park at various global fora. ANDES has engaged actively in relevant policy fora such as The Food and Agriculture Organization of the United Nations Treaty on Plant Genetic Resources, the Convention on Biological Diversity and IUCN, which has enhanced recognition and support for the Potato Park both internationally and nationally.

- Collaboration with national and international research centres and universities.

Is the EbA initiative sustainable?

Local-level support for the Potato Park is enough to ensure sustainability of the initiative, but the threat of mining remains and the political environment is not always conducive to sustainability. The turnover in government officials is problematic. Registering the Potato Park under the law on agrobiodiversity zones will ameliorate this threat. Unlike many other projects, much effort has been made to support participatory approaches, and this is likely to improve long-term sustainability. Sustainability is in fact the basis of the management model, and self-management of the park and independence from external funding help make this a reality.

At the regional level, the policy environment was not conducive to sustainability at the start of the project, but the Potato Park helped create a favourable policy environment as it matured.

Support at the national level helps ensure sustainability because the Potato Park is likely to be registered under the new agrobiodiversity zone law. Mining remains a threat, however, and the Potato Park needs to be integrated into other areas of public policy. ANDES is working on this.

The international legal and policy context is also important here, including commitments made under the Convention on Biological Diversity, the United Nations Food and Agriculture Organisation Treaty on Plant Genetic Resources for Food and Agriculture, and the United Nations Declaration on the Rights of Indigenous Peoples. International Potato Park recognition gained via IUCN has also provided support.

Opportunities for replication, scaling up or mainstreaming the EbA initiative or for influencing policy

A number of opportunities for replication, scaling up or mainstreaming, or for influencing policy, emerged from the Potato Park initiative. National level 'roll out' through top down programmes may not be desirable, however, as agrobiodiversity management approaches need to be bottom-up in order to be effective and sustainable.

- Within Peru, regional governments are interested in replicating the Potato Park model and the national government could provide funding for this. The regional government of Apurimac is very keen to replicate the approach, for example, and attended a recent horizontal learning exchange to scale out the Potato Park biocultural heritage territory model, coordinated by the International Network of Mountain Indigenous People (Swiderska and INMIP 2017).
- The new Aagrobiodiversity zones law should facilitate wider scaling up. The Potato Park will register itself as a biocultural heritage territory under this, providing a precedent for wider scaling out.
- The Potato Park model has been replicated in many countries globally, supported by IIED (Swiderska and Argumedo 2014). Learning exchanges under the International Network of Mountain Indigenous Peoples are helping communities in Stone Village, China, to replicate the biocultural heritage territory model (Reilly and Swiderska 2016). The Mexican government sent six officials to the Potato Park in 2016 to learn about it, claiming it was the best example in Latin America.
- The International Network of Mountain Indigenous People is spreading the approach to ten other countries through annual horizontal learning exchanges for indigenous communities (Swiderska and INMIP 2017).[5]
- The Crop Trust, formerly known as the Global Crop Diversity Trust, manages crop gene banks globally and wants to replicate the Potato Park model.

Summary and conclusions

The Potato Park provides an example of how community-led EbA focusing on agrobiodiversity and biocultural heritage can be an effective approach to tackling climate change. Genetic diversity – especially agrobiodiversity when used in the context of food and agriculture – can provide a key

[5] See also www.inmip.net

ecosystem service for adaptation. As such, it should be a core component of many EbA initiatives. Most EbA initiatives focus on other components of biodiversity and ecosystem services, however, and adaptation initiatives involving agrobiodiversity tend to be branded as 'climate smart agriculture' rather than EbA. Projects such as the Potato Park can be classified as both.

Effectiveness for human societies

Resilience and adaptive capacity improved, and vulnerability reduced, as a result of Potato Park activities. This was due to significant increases in genetic diversity and the number of resilient varieties, the adoption of highly participatory and empowering participatory action research approaches that built capacity for research and confidence in traditional knowledge, the building of collective local institutions, the linking of scientific and indigenous knowledge, better access to information, livelihood improvements and economic diversification, and improved landscape management and agrobiodiversity conservation practices. In particular, indigenous people, women and the poor and vulnerable experienced changes to resilience, adaptive capacity and vulnerability. No trade-offs were experienced in terms of who benefitted or where and when these benefits accrued. Collective management and conservation systems were in place after one to two years, and this increased resilience by stopping the loss of genetic diversity from farmers' fields and landscapes, but building self-sustaining resource management systems (ie strong local institutions, capacity and economic incentives) took more time (around five to ten years).

A multitude of social co-benefits emerged from the Potato Park, including a number of cultural, territorial and biodiversity-related benefits, livelihood provision/diversification, improved food security and health, improved security and reduced conflict over resources, improved social cohesiveness, stronger local institutions, policies and governance, climate change mitigation, disaster risk reduction, and benefits from networking and new alliances. No social groups accrued more of social benefits than others, thanks to a strong emphasis on community leadership and the core values of equity and solidarity enshrined in Andean customary laws.

Indigenous knowledge and highly participatory action research approaches have been key to the success of the Potato Park and central to increasing adaptive capacity. They have built strong local ownership to ensure long-term sustainability. Local culture and knowledge is central to park management, and participation is characterised primarily as 'self-mobilisation' or 'interactive'. Given this, Swiderska (2016a) argues in general for greater emphasis on traditional knowledge in adaptation planning.

Effectiveness for the ecosystem

A number of factors threaten ecosystem resilience and service provision: climate change, land conversion and over-exploitation, obstructive governance and genetic erosion.

The landscape was considered a key management unit for sustaining ecosystem resilience. This encompasses the watershed as well as biocultural heritage, including wild plants and animals, and highland pastures. Agrobiodiversity was conserved on farmers' fields and in the landscape (including crop wild relatives), enhancing the resilience of agro-ecosystems.

The extent of warming was considered a key threshold above which glaciers would disappear and ecosystems would be irrevocably changed.

The Potato Park improved ecosystem resilience and the availability of provisioning ecosystem services, cultural services and regulating and supporting services. Services were restored and enhanced at the landscape level, and no trade-offs between the delivery of different ecosystem services at different geographical scales were experienced. Ecosystem services are likely to be maintained over the long term, but whilst some ecosystem services (namely agrobiodiversity) improved after two years, it took five to ten years to ensure the governance structures were in place to secure ecosystem service delivery far into the future. There were no trade-offs between the delivery of different ecosystem services at different timescales.

Financial effectiveness

No formal cost-benefit analysis has been conducted, but the fact that Potato Park activities are self-determined, and that an increase in community income-generating capacity has occurred, suggests that the park is cost-effective. Economic benefits from increases in capacity, social capital and social cohesion are hard to quantify, however, and most cost-benefit analyses tend to ignore indigenous valuation methods and priorities (for example, by excluding the economic benefits of non-monetary exchanges such as bartering, which is so important for Quechua mountain communities).

There are multiple broader economic benefits from the Potato Park, including avoided losses from disasters, local income enhancement, economic benefits from land rights, ownership and land value increases, and the safety net provided by bartering. Some government sectors might argue, however, that there are opportunity costs, for example from lost mining opportunities.

There were no apparent financial or economic trade-offs between management at different geographical scales, and although it has taken five to ten years for economic benefits to materialise, income from the Potato Park has increased over time despite severe climate change impacts.

Policy and institutional issues

A number of local, regional and national-level barriers have proved challenging over the years. Many of these relate to government at these different levels. Insufficient government prioritisation, capacity and knowledge, weak or unsupportive policies and laws, corruption and uncoordinated government institutional and policy responses were key. The loss of indigenous knowledge and culture, and the need to improve indigenous peoples' representation in decision making was also important.

Local-level opportunities for implementing Potato Park activities came from project champions, strong community incentives, strong local institutions, and external technical support. At the regional and national level, existing (or the introduction of more) supportive policies and legislation, supportive government staff, collaboration with external institutions, improving collaboration between ministries and international exposure all contributed to project success. Engagement with international processes and global recognition has also helped build recognition and in-country support.

Potato Park activities are likely to be sustainable in the long term, but external threats from mining and changing political priorities remain.

A number of opportunities for replication, scaling up or mainstreaming or for influencing policy, emerged from the Potato Park initiative. Different regions in Peru are interested in replicating the Potato Park model, and the new agrobiodiversity zones law should facilitate wider scaling up. The model is also being replicated in other countries and indigenous communities globally.

References

Adnan, S., A. Barren, S.M. Nurul Alam and A. Brustinow (1992) *People's participation: NGOs and the flood action plan*. Research and Advisory Services: Dhaka, Bangladesh.

Anderson, S. (2014) *Getting ahead of the curve: when climate adaptation has to get radical*. Briefing paper, IIED, London.

ANDES et al. (2011) *Community biocultural protocols. Building mechanisms for access and benefit-sharing among the Communities of the Potato Park based on customary Quechua norms*. IIED, London.

Andrade, A., R. Córdoba, R. Dave, P. Girot, B. Herrera-F, R. Munroe, J. Oglethorpe, P. Paaby, E. Pramova, E. Watson and W. Vergara (2011) *Draft Principles and Guidelines for Integrating Ecosystem-based Approaches to Adaptation in Project and Policy Design: a discussion document*. IUCN-CEM, CATIE. Turrialba, Costa Rica.

ARCAB (2012) *Action Research for Community Adaptation in Bangladesh: Monitoring and Evaluation Framework Paper*. Final report.

Argumedo, A. (2013) *Collective trademarks and biocultural heritage. Towards new indications of distinction for indigenous peoples in the Potato Park, Peru*. Issues Paper. IIED, London.

Asociación ANDES (2016) R*esilient farming systems in times of uncertainty: Biocultural innovations in the Potato Park, Peru*. SIFOR quantitative baseline study. IIED, London.

Asociación ANDES and the Potato Park (2015) *Biocultural Heritage Innovations in the Potato Park. SIFOR Qualitative Baseline Study, Peru*. IIED, London.

Ayers, J., S. Anderson, S. Pradha and T. Rossing (2012) *Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation: A Manual for Local Practitioners*. CARE International.

Bertram, M., E. Barrow, K. Blackwood, A. R. Rizvi, H. Reid and S. von Scheliha-Dawid (2017) *Making Ecosystem-based Adaptation Effective: A Framework for Defining Qualification Criteria and Quality Standard*. Friends of Ecosystem-based Adaptation (FEBA) technical paper developed for UNFCCC-SBSTA 46. GIZ, Bonn, Germany, IIED, London, UK, and IUCN, Gland, Switzerland.

Biesbroek, G. R., C. J. A. M. Termeer, J. E. M. Klostermann and P. Kabat (2013) 'On the nature of barriers to climate change adaptation.' *Regional Environmental Change* 13: 1119-1129.

Black, D., J. K. Turpie and N. Rao (2016) 'Evaluating the cost-effectiveness of ecosystem-based adaptation: Kamiesberg Wetlands case study.' *SAJEMS Asset Research NS* 19(5): 702-713.

CBD (2009) *Convention on Biological Diversity 2009: Connecting Biodiversity and Climate Change Mitigation and Adaptation. Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change*. CBD Technical Series No. 41. Secretariat of the Convention on Biological Diversity, Montreal, Canada.

CBD (2010) Convention on Biological Diversity 2010: Decision adopted by the Conference of the Parties to the Convention on Biological Diversity at its 10th Meeting. X/33. Biodiversity and climate change. UNEP/CBD/COP/DEC/X/33.

Chong, J. (2014) 'Ecosystem-based approaches to climate change adaptation: progress and challenges.' *International Environmental Agreements: Politics, Law and Economics* 14(4): 391-405.

Dazé, A., K. Ambrose and C. Ehrhart (2009) *Climate Vulnerability and Capacity Analysis: Handbook*. CARE International.

Doswald, N., R. Munroe, D. Roe, A. Giuliani, I. Castelli, J. Stephens, I. Möller, T. Spencer, B. Vira, H. Reid et al. (2014) 'Effectiveness of ecosystem-based approaches for adaptation: review of the evidence-base.' *Climate and Development* 6(2): 185-201.

Faulkner, L., J. Ayers and S. Huq (2015) 'Meaningful measurement for community-based adaptation.' In: D. Bours, C. McGinn and P. Pringle (eds) *Monitoring and evaluation of climate change adaptation: A review of the landscape New Directions for Evaluation*, 89–104.

GEF (2012) *Operational Guidelines on Ecosystem-Based Approaches to Adaptation*. LDCF/SCCF Council meeting, Washington, DC, 15 November.

Girot, P., C. Ehrhart, J. Oglethorpe, H. Reid, T. Rossing, G. Gambarelli, H. Jeans, E. Barrow, S. Martin, N. Ikkala and J. Phillips (2012) *Integrating community and ecosystem-based approaches in climate change adaptation responses*. ELAN, unpublished.

Jeans, H., J. Oglethorpe, J. Phillips and H. Reid (2014) 'The role of ecosystems in climate change adaptation: Lessons for scaling up.' In: E. L. F. Schipper, J. Ayers, H. Reid, S. Huq and A. Rahman (eds) *Community Based Adaptation to Climate Change: Scaling it up*. Routledge, London, 253-265.

Jones, H. P., D. G. Hole and E. S. Zavaleta (2012) 'Harnessing nature to help people adapt to climate change.' *Nature Climate Change* 2(7): 504-509.

Martin, S. (2016) *EbA revisited, part 1: disentangling misconceptions about nature and adaptation*. WWF, Washington DC. http://www.climateprep.org/stories/2016/6/14/eba-revisited-part-1-disentangling-misconceptions-about-nature-and-adaptation

Ojea, E. (2015) 'Challenges for mainstreaming Ecosystem-based Adaptation into the international climate agenda.' *Current Opinion in Environmental Sustainability* 14: 41-48.

Reid, H. (2011) *Improving the evidence for ecosystem-based adaptation*. IIED Opinion: lessons from adaptation in practice series. IIED, London.

Reid, H. (2014a) 'A natural focus for community-based adaptation.' In: J. Ensor, R. Berger and S. Huq (eds) *Community-based Adaptation to Climate Change: Emerging Lessons*. Practical Action Publishing, Rugby, 35-54.

Reid, H. (2014b) *Ecosystem- and community-based adaptation: learning from natural resource management*. Briefing paper. IIED, London.

Reid, H., T. Cannon, R. Berger, M. Alam and A. Milligan (2009) Community-based adaptation to climate change. *Participatory Learning and Action* 60. IIED, London.

Reid, H., N. Seddon, E. Barrow, C. Hicks, X. Hou-Jones, V. Kapos, A. R. Rizvi, D. Roe and S. Wicander (2017) *Ecosystem-based adaptation: question-based guidance for assessing effectiveness*. IIED, London.

Reilly, J. and K. Swiderska (2016) *Biocultural Adaptation in Mountain Communities. Third INMIP International Learning Exchange, Stone Village, China*. Event report. IIED, London.

Renaud, F. G., K. Sudmeier-Rieux, M. Estrella (2013) *The role of Ecosystems in disaster risk reduction*. UN University Press, Tokyo/New York/Paris.

Seddon, N., X. Hou-Jones, T. Pye, H. Reid, D. Roe, D. Mountain and A. R. Rizvi (2016a) *Ecosystem-based adaptation: a win-win formula for sustainability in a warming world?* Briefing paper. IIED, London.

Seddon, N., H. Reid, E. Barrow, C. Hicks, X. Hou-Jones, V. Kapos, A. R. Rizvi and D. Roe (2016b) *Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy: Research overview and overarching questions*. IIED, London.

Sietz, D., S. E. M. Choque and M. K. B. Lüdeke (2012) 'Typical patterns of smallholder vulnerability to weather extremes with regard to food security in the Peruvian Altiplano.' *Regional Environmental Change* 12: 489-505.

Stenner, T., A. Argumedo, D. Ellis and K. Swiderska (2016) 'Potato Park - International Potato Center - ANDES Agreement: Climate Change Social Learning (CCSL) case study on the repatriation of native potatoes'. In: M. Van Epp and B. Garside (eds) *Solving 'wicked' problems: can social learning catalyse adaptive responses to climate change? A compendium of case studies*. IIED, London.

Swiderska, K. (2016a) *Landscape approaches for mountain community sustainable development in a time of climate change. Policy consultation and South-South exchange workshop*. Event Report. IIED, London.

Swiderska, K. (2016b) *SIFOR submission to the UNFCCC on agriculture*. IIED, London

Swiderska, K. and A. Argumedo (2014) *Mountain Communities Workshop on Climate Change and*

Biocultural Heritage: An International Exchange on Indigenous Knowledge, Values and Strategies for Adaptation. IIED, London.

Swiderska and INMIP (2017) *Resilient biocultural heritage landscapes for sustainable mountain development*. Fourth horizontal learning exchange, International Network of Mountain Indigenous Peoples (INMIP). Event report. IIED, London

Travers, A., C. Elrick, R. Kay and O. Vestergaard (2012) *Ecosystem-based adaptation guidance: moving from principles to practice*. UNEP.

UNEP (2012) *Making the case for ecosystem-based adaptation: building resilience to climate change*. UNEP, Nairobi.

Urrutia, R. and M. Vuille (2009) 'Climate change projections for the tropical Andes using a regional climate model: Temperature and precipitation simulations for the end of the 21st century.' *Journal of Geophysical Research* 114(D2).

Vignola, R., B. Locatelli, C. Martinez and P. Imbach (2009) 'Ecosystem-based adaptation to climate change: What role for policy-makers, society and scientists?' *Mitigation and Adaptation Strategies for Global Change* 14(8): 691-696.

Vignola, R., T. L. McDaniels and R. W. Scholz (2013) 'Governance structures for ecosystem-based adaptation: Using policy-network analysis to identify key organizations for bridging information across scales and policy areas.' *Environmental Science and Policy* 3: 71-84.

Vuille, M., B. Francou, P. Wagnon, I. Juen, G. Kaser, B. G. Mark and R. S. Bradley (2008) 'Climate change and tropical Andean glaciers: Past, present and future.' *Earth-Science Reviews* 89(3-4): 79-96.

Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall strategy to help people to adapt to the adverse effects of climate change and promote sustainable development. This report presents the results of using our Framework for Assessing EbA Effectiveness at the Potato Park and the Indigenous Peoples Biocultural Climate Change Assessment, Peru. The findings will be combined with those from 12 other sites in 11 other countries to help show climate change policymakers when and why EbA is effective.

Project Report

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