

Costs and benefits of Adaptation

Afternoon session

Bonn, July 2016

Session

- Introductions
- Presentation - Adaptation gap report
- Break out discussion session
- Presentation – Information on costs and benefits and early use
- Discussion

Discussion session

- State of play
- Where are you on identifying costs and benefits in your NAPs?
- What are the key challenges you are facing?
- What information and support would be useful for you?



STEP B.3.

Reviewing and appraising adaptation options

Key questions

- What are the costs and benefits of each adaptation option?
- How best can the adaptation options be implemented, and what are the conditions for success?
- Is it possible to identify co-benefits between the adaptation options and development?

Indicative activities

- a. Appraise individual adaptation options, including economic, ecosystem and social costs and benefits, and possibilities for unintended (positive and negative) impacts of adaptation measures

Information, resource and methods

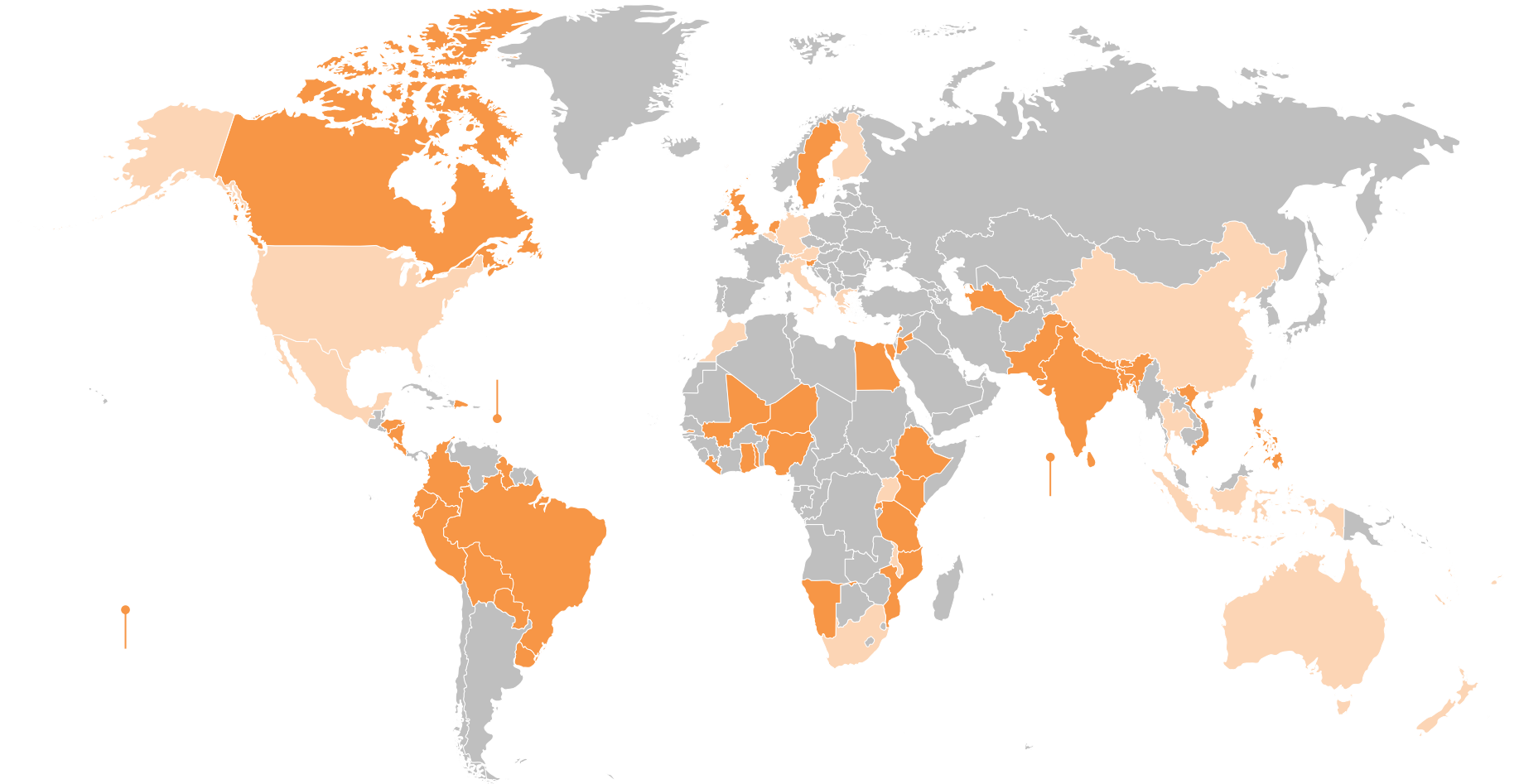
- Information sources to help in identifying costs and benefits
- And how they might be used in early appraisal

State of knowledge on costs and benefits

- Estimating costs and benefits – and prioritisation - one of more difficult aspects of NAPs
- IPCC 5th AR reports a low evidence base on the costs and benefits of adaptation
- But over the last few years, information base grown
- ECONADAPT undertaken comprehensive review – identified ~700 relevant studies

Coverage of national studies

ECONADAPT



■ National assessment studies and initiatives ■ Other studies with national or sub-national coverage

Coverage of Sectors/Risks

Risk / Sector	Coverage/ Discussion	Cost estimates	Benefit estimates
Coastal zones and coastal storms	Comprehensive coverage at global, national and local level in impact assessment and policy studies + low regret options decision making under uncertainty.	✓✓✓	✓✓✓
Floods including infrastructure	Growing cost and benefit estimates in a number of countries and local areas, particularly river flooding. Some evidence on low regret options and non-technical options. Some applications of decision making under uncertainty.	✓✓	✓✓
Water management	Emerging supply-demand studies at the national level. Focus on supply, engineering measures. Some examples of decision making under uncertainty.	✓✓	✓
Other infrastructure	Several studies on road and rail infrastructure. Examples of wind storm and permafrost.	✓	✓
Agriculture	Benefits of farm level adaptation, and some benefits and costs at global and national level. Evidence emerging on low regret adaptation, including climate smart agriculture.	✓✓	✓✓
Over-heating (built environment, energy and health)	Good cost information on heat-alert schemes. Increasing coverage of autonomous costs* associated with cooling. Growing evidence base on low-regret options (e.g. passive cooling).	✓✓	✓
Other health risks	Increasing studies of preventative costs for future disease burden (e.g. water, food and vector borne disease), but partial.	✓	✓
Biodiversity / ecosystem services	Low evidence base, with a limited number of studies on restoration costs and costs for management of protected areas for terrestrial ecosystems.	✓	
Business, services and industry	Very few quantitative studies available, except for tourism,.	✓	

The Costs and Benefits of Adaptation

Results from the *ECONADAPT* project



Funded by
the European Union



First Draft July 2015



www.econadapt.eu

ECONADAPT



Funded by
the European Union

Potential resource for NAPS

- ECONADAPT Inventory on studies on costs and benefits of adaptation
- Just finalising and testing. Completed next 2 months
- We will distribute the inventory to NAP participants
- Provides information, but does not do analysis for you



ECONADAPT / LIBRARY

POLICY AREAS CONSIDERED

- agriculture (186)
- biodiversity (62)
- buildings & construction (56)
- civil protection & disaster risk management (10)
- coastal protection (114)
- energy (69)
- finance & insurance (32)
- fisheries (35)
- forestry (59)
- general (89)
- human health (103)
- industry (18)
- regional & urban planning (116)
- tourism (42)
- transport (63)
- water management (200)

DECISION SUPPORT TOOLS

- adaptive management (iterative risk management) (14)
- cost-benefit assessment (254)
- cost-effectiveness assessment (52)
- multi-criteria analysis (mca) (29)
- portfolio analysis (pa) (5)
- real option analysis (roa) (23)
- robust decision making (rdm) (34)

SCALE

LIBRARY SEARCH



Showing 1 - 30 of 619 results

1 2 3 4 5 ... Next Last»

[A qualitative assessment of climate adaptation options and some estimates of adaptation costs](#)

The aim of the current study is to provide a 'qualitative assessment' of the direct and indirect effects of adaptation options and to provide an assessment of some of the costs and benefits of adaptation options. The present report presents and summarizes the results of all phases of the study: an inventory of adaptation options, a qualitative assessment of the effects of the adaptation options for the Netherlands in the long run, a database which allows to rank the various options according to a set of criteria and a relative ranking on the basis of these criteria.

[Health Impact of Climate Change](#)

Description of the relative direction, magnitude, and certainty of climate change-related health impacts and describe costs of interventions

[Adaptation Options on Natural Ecosystems.](#)

Thus it is very difficult to define a coherent operational adaptation strategy for natural ecosystems. The report tries the even more difficult, estimation of the financing needs for adaptation, although investment in current conservation can provide some guidelines as to costs and to financing opportunities.

[The Costs to Developing Countries of Adapting to Climate Change: New Methods and Estimates](#)

To shed light on adaptation costs—and with the global climate change negotiations resuming in December 2009 in

How can you use this resource?

- Look up relevant studies in an area of focus (e.g. sector or risk)
- See if there is information on costs and benefits of the options
- Provide information on ranking of options

- But note of caution

- Transferring estimates requires care

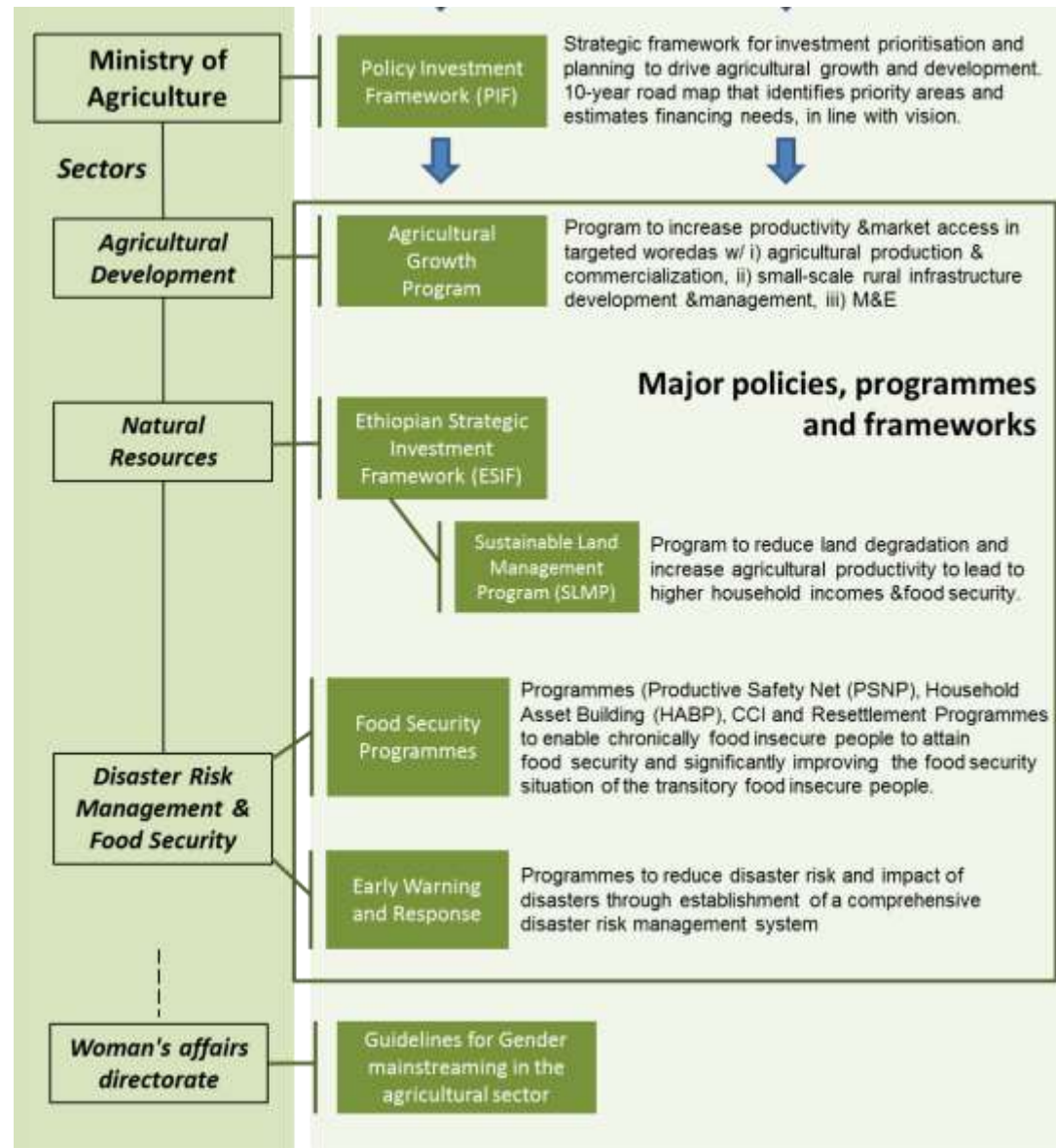
- Also many studies are technical/academic, not so relevant for NAPs

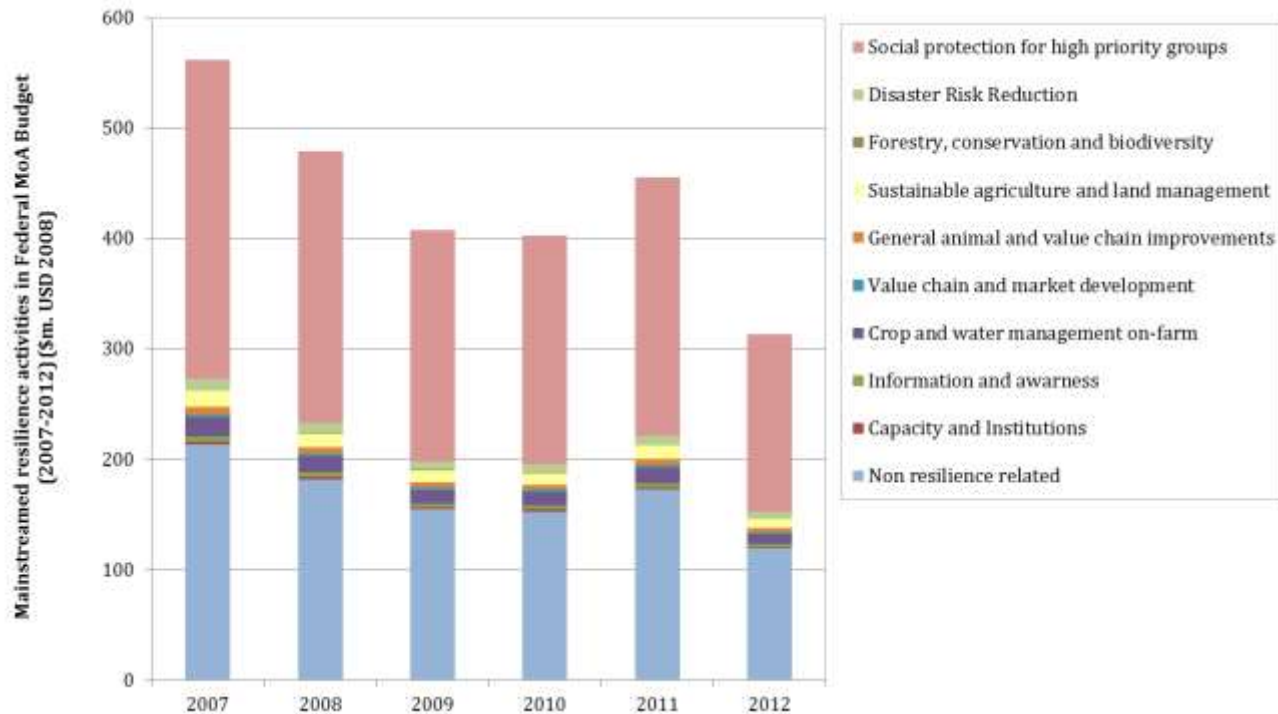
Other information sources costs / benefits

- Sectors (Ministries) will already be doing similar activities
 - Can look into relevant programme budgets to look at cost estimates
- There will be sector project funded by development partners which have costs and often more detail
 - Appraisal/evaluation will have costs and benefits and co-benefits
- Existing climate finance projects (e.g. Adaptation Fund, LCDF) country or similar activities in other countries
- Particularly relevant for early low regret options

Example from Ethiopia

- Looking at building cost estimates in agriculture
- Looked at literature
- Identified relevant programmes in Ministry
- Investigated costs of programmes
- DP documents provide additional information





- Ministry budgets
- Costs of current programmes
- Costs of activities, e.g. costs per hectare for climate smart agriculture

- Donor documents
- Appraisals and evaluations
- E.g. PSNP
- E.g. SLMP

	Average over all observations			Average over positive observations		
	mean	quartiles		mean	quartiles	
		25%	75%		25%	75%
Agricultural techniques						
Crop selection	114	0	150	205	80	240
Adapt planting dates	29	0	0	125	50	150
Adapt cropping densities	53	0	16	202	50	320
Adapt fertilizer/pesticide application	242	0	400	351	80	525
Adapt tillage practices	20	0	0	152	60	175
Change the herd composition	28	0	0	196	50	200
Apply different feed techniques	213	0	250	483	140	600
Improve food storage facilities	120	0	26	191	10	120
Improved seeds	187	0	265	257	200	290
Water management techniques						
Use water harvesting techniques	61	0	0	303	158	450
Use irrigation	215	0	204	485	78	405
Income diversification techniques						
Home-garden agriculture	28	0	0	146	50	175
Communal pooling techniques						
Communal irrigation	560	0	0	1607	100	300

Notes: For the averages over the positive observations, the observations are excluded for which households indicated they had made costs but for which they reported a cost estimate of 0 Birr. See also Tables C.3 and C.4.

Appraisal of options and prioritization

- Once have identified major risks – both today and in the future
- And long list of options
- And have some information on costs, benefits and other criteria
- Can filter these down (ranking or prioritisation)

Appraisal of options and prioritization

- Use decision support tools to undertake prioritisation
- Multi-criteria analysis, cost benefit analysis, cost-effectiveness analysis
- Initially most likely to be some form of multi-criteria or multi-attribute analysis
- Combine information on costs, benefits, other criteria with consultation

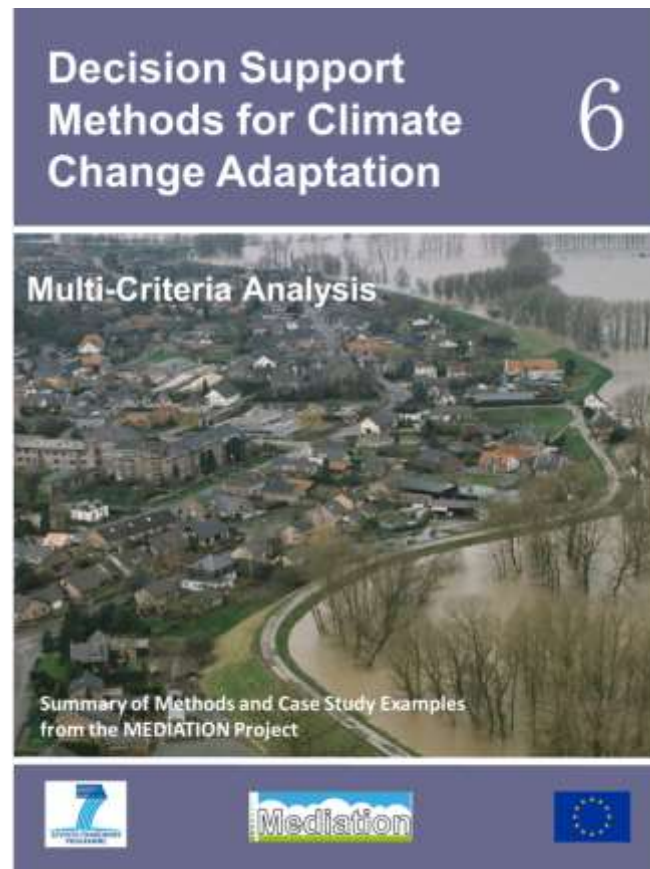
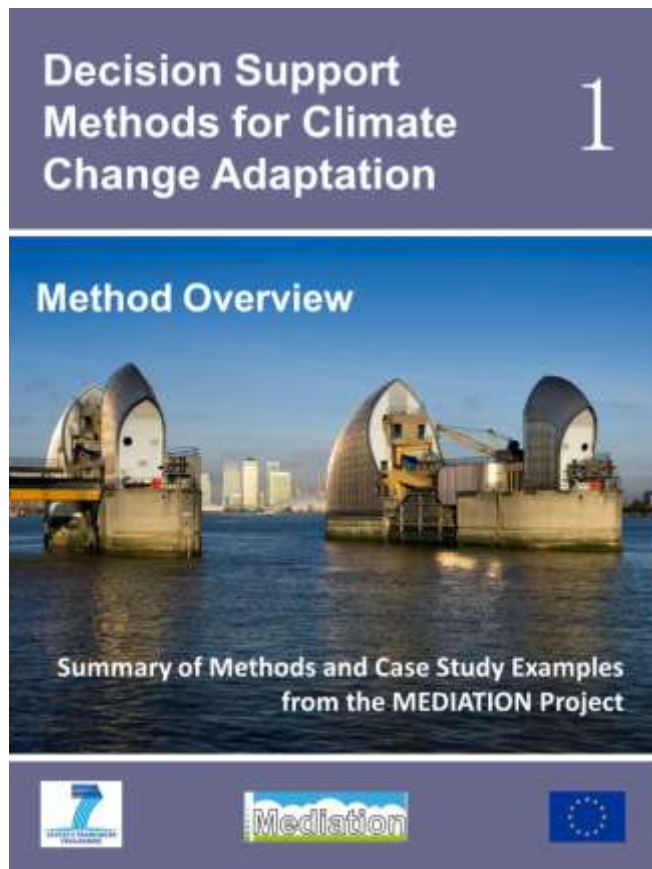
Criteria in the NAP guidance

- Timing/urgency for action;
- Cost: general cost of proposed strategies, including human and other resources, and where relevant, economic costs and benefits;
- Co-benefits: whether the strategies would have negative or positive impacts on other sectors or systems,
- Efficacy: the extent to which the measure is able to effectively reduce the risk; 'No regrets'. 'No regrets' solutions
- Flexibility or robustness: measures that allow for adjustment or change in the future
- Overall contribution of the measures to poverty reduction,
- Contribution to sustainable development and strategic relevance to national development goals;
- Social and political acceptance;
- Economic, social, technological and environmental feasibility.

Methods

Guidance on methods (Mediation and PROVIA)

<http://mediation-project.eu/>



STEP C.1.

Prioritizing climate change adaptation in national planning

Key questions

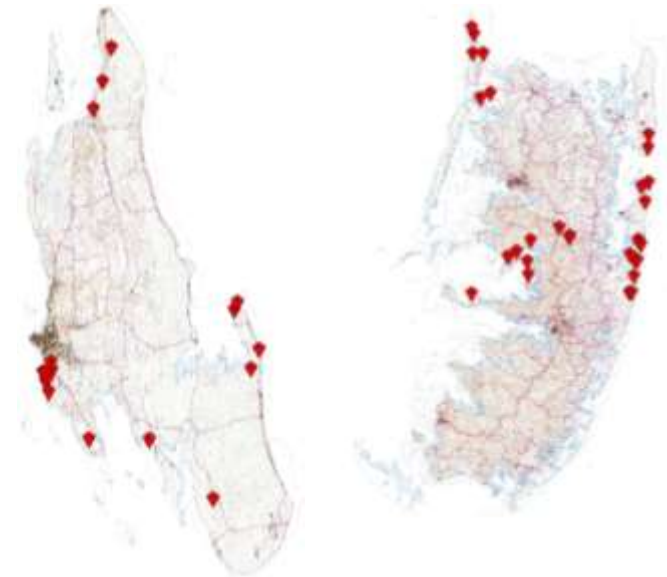
- How can adaptation work best be prioritized for implementation at the national level considering development needs, climate vulnerabilities and risks and existing plans?
- What criteria can be used to define priority actions?

Indicative activities

- a. Define national criteria for prioritizing implementation based on, inter alia, development needs, climate vulnerability and risk and existing plans
- b. Identify opportunities for building on and complementing existing adaptation activities

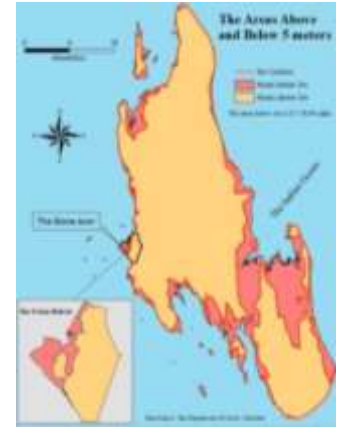
Current priority risks on Zanzibar

- Already seeing problems with salt water intrusion – identified 148 sites on the islands.
 - Also leading to water contamination
- Agricultural production very climate sensitive
 - Losses in dry years (e.g. 2005 and 2009)
- Extreme rainfall and storm-surge an issue with heavy rainfall and floods
- Marine environment– coral bleaching in hot years (El Nino)
- Seaweed farming being affected by high sea surface temperature



Future priority risks CC on Zanzibar

- Temperature rise by 1 – 2 degree centigrade
- Sea level rise a major threat ~ 20 – 30% of islands low lying
- Changes in coastal and marine environment major threat
 - Higher sea temperature affect sea weed, fisheries, corals
- Agricultural production at potential risks
 - including clove trees which dominate exports
- Impacts on tourism, attractiveness of the climate



Zanzibar Climate Change Action Plan

- Focus of the action plan to produce costed pipeline for climate finance
- Policy first - aligning to national and sector development objectives, entry point
- Using iterative risk and economics to help prioritise risks and options
- 500 – 120 - 30

Priorities identified in the Zanzibar Climate Change Strategy



Consultation meetings (Unguja and Pemba) to outline approach

Updated climate risk and low carbon analysis

Long-list of adaptation and low carbon options

Analysis of national and sector development plans and entry points.
Consultation with RGZ

Prioritisation – based on magnitude, urgency, costs and benefits.
Stakeholder ranking by sectors with RGZ.

Consultation meetings (Unguja & Pemba) to discuss priority options

For priorities, analysis of activities, indicative costs, resource mobilisation, responsibility and next steps



Next step. Detailed design and costed plan (climate finance ready) for each priority option

Zanzibar Climate Change Action Plan

- Prioritisation
 - The magnitude (importance) of the climate risk or low carbon opportunity.
 - The potential for economic, social and environmental benefits, and the potential costs of the interventions.
 - The urgency of the adaptation or low carbon intervention.
 - The ranking of priorities from Departments.
- Prioritisation process led to identification of around 30 priorities
- For each of these, developed an iterative plan
- And then produced analysis of costing and implementation

Theme / priority area	Early low–regret options and capacity building	Climate smart planning	Early action for future climate challenges
Capacity building programme	Capacity building, technical assistance and training across Government, including awareness raising. Includes support in key areas of design, implementation and M&E of Action Plan interventions and mainstreaming, as well as the Climate Finance Mechanism/Resource Mobilisation.	Capacity building and technical assistance for Mkuza II successor strategy and ZPC project development guide.	Climate research programme, possibly with University curriculum and overseas collaboration and training programme. Climate change policy fellows and science fellows programme
Risk information for coastal flooding and sea level rise	Use of information in DRR and early warning.	High resolution risk maps for elevation and possible risks from sea-level rise and storm surge (geodata). Storm surge model development. Development of rainfall flood risk maps. Integrate information for land-use plan and use in development planning and application.	New tide gauge monitoring programme (e.g. Pemba station). Additional sea surface loggers. Enhanced wind and wave height monitoring programme, acidification, etc. Research study on WIO tropical cyclone and CC.
Sea-weed farming resilience programme	Resilience programme, with scale-up of low-regret options to improve production and quality, awareness raising, plus diversification (e.g. sea-cucumbers).	Possible consideration of sites of current or future development of the industry (e.g. district to national planning).	Monitoring and research on new varieties and changing practice, moving to pilots. Research on algal blooms on seaweed and other disease (recent die-off and future risks).
Clove resilience programme	Seedling production, pilot low regret options (e.g. drip irrigation, shade trees for seedlings, water conservation, inter-cropping, tree belts,), capacity building, awareness (especially on survival rates seedlings).	Analysis of varietal suitability, siting and management practices for future planting.	Research into climate risks and variety/management. Investigation (monitoring?) of future risks, notably wind/cyclone

Zanzibar Climate Change Action Plan

- Built up cost estimates, resource mobilisation and responsibilities

Theme / priority area	Indicative cost estimate (2016 – 2021)	Possible Resource mobilisation	Responsibility and Next steps
Climate information, capacity building DRM and Sustainable Settlements			
Capacity building programme	\$1 -2 M (based on current programme size of UNDAP).	UNDAP II. AfDB capacity building project DFID AIM4Resilience Technical assistance NORHED programme (IMS/SUZA)	Department of Environment, but also key roles for Ministry of Finance and Planning Commission, as well as sectors. <ul style="list-style-type: none"> • Capacity needs assessment (end 16) • Design of capacity building programme (mid 17).
Risk mapping for coastal flooding and sea level rise	Drone mapping proposed by World Bank provide elevation data. Additional costs to provide digital risk maps (\$0.1M). WB coastal resilience (DHI/Samaki, 2014) estimates cost for Information system for Decision Support for Coastal Development Management system for coastal development \$1.3 M* Estimates spatial planning system \$2.3M*	World Bank drone mapping project (proposed, subject to open access) World Bank/UNDP DRR	MLHWE, DoE, DMD (2 nd VPO) <ul style="list-style-type: none"> • Discussion on open access data and request to World Bank for drone mapping (2016). • Discussion on GIS and information sharing • Production maps (2017).

- Identify pipeline of ~ \$50M for first action plan period
- And moving into detailed design and climate finance ready proposals

Case Study Ethiopia

- Climate Resilience Strategy
- Start with current climate variability and adaptation deficit
- Consider future climate and uncertainty
- Develop phasing of options – what do now versus later
- Base around existing policy and development plans

Ethiopia has high vulnerability (livelihood)s

HIGHLAND CROPPING SYSTEM		TEMPERATURE			PRECIPITATION					SEASONAL CHANGES									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Pastoralists		1	1	1	3	2	2	2	1	2	2	2	4	4	3	3	1	1	1
Smallholder dryland farming	Coffee/Cereal	1	1	1	2	1	3	3	1	2	2	2	3	4	3	3	2	2	1
	Cereal/Pulse	1	2	2	3	1	3	4	3	4	2	3	3	4	3	3	2	2	2
Commercial farming		1	1	2	1	1	3	4	4	4	3	3	3	3	2	2	3	3	1

Key	
1	Business as usual
2	Minor issue
3	Medium issue
4	Major issue
5	Catastrophic change



Legend
■ High Rainfall/ Productive
■ Low Rainfall/ Hungry
■ Pastoral

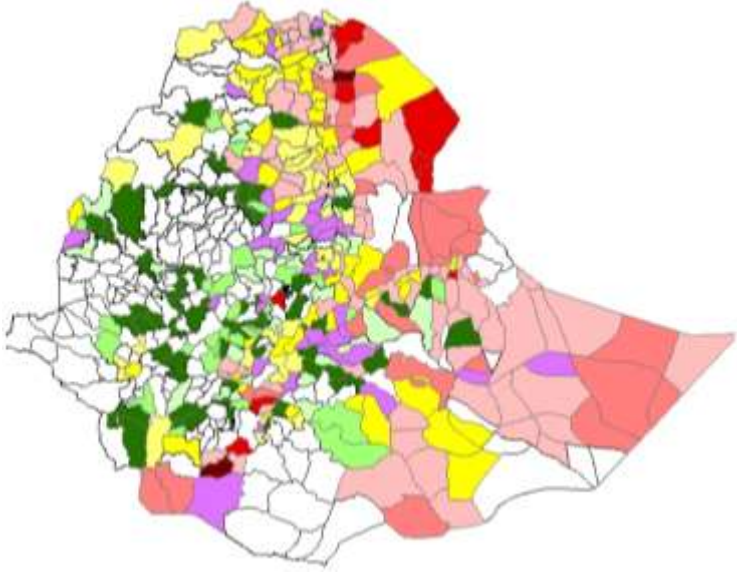
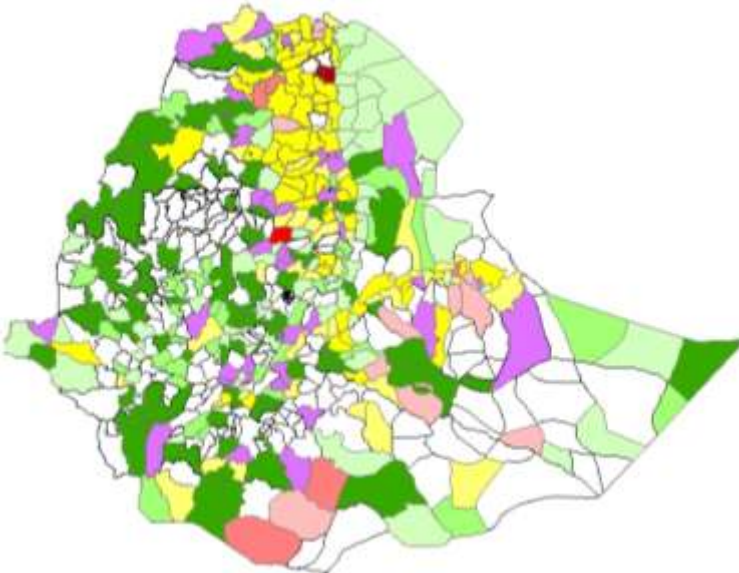
ETHIOPIAN ARID LOWLANDS

AGROPASTORAL / TRANSITION ZONE		TEMPERATURE			PRECIPITATION					SEASONAL CHANGES									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Agro-pastoral		1	1	3	4	2	2	1	1	1	2	3	3	4	3	3	1	1	1
Small-holder dryland farming	Coffee/ chat/cereal & livestock	1	1	3	3	1	3	3	2	1	2	2	3	5	2	3	2	2	2
	Cereal/pulse/teff & livestock	1	2	3	4	1	3	4	3	3	4	4	4	5	3	3	2	3	2
	Horticulture/en set	1	3	2	3	1	3	4	3	3	3	3	3	5	3	3	2	3	2
Trade networks		1	2	2	1	1	3	4	3	2	1	1	4	4	1	1	1	1	1

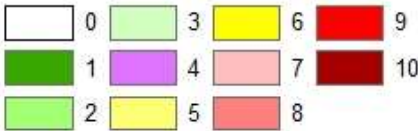
PASTORAL LOWLANDS		TEMPERATURE			PRECIPITATION					SEASONAL CHANGES									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Pastoralists		1	2	4	4	1	NA	1	1	NA	1	1	4	5	1	1	1	1	2
Agro-pastoralists		2	2	4	3	1	NA	2	2	NA	2	3	2	4	2	2	1	2	1
Smallholder irrigated cropping		2	3	4	2	1	NA	2	2	NA	1	1	1	3	1	1	2	2	1
Commercial (Sugar cane)		1	2	3	2	1	NA	1	3	NA	2	3	2	3	3	2	2	2	2
Traders		1	1	4	2	1	NA	2	2	NA	1	1	2	3	1	1	2	1	1

Driven by climate but also wider socio-economic drivers

Exposed to major climate extremes

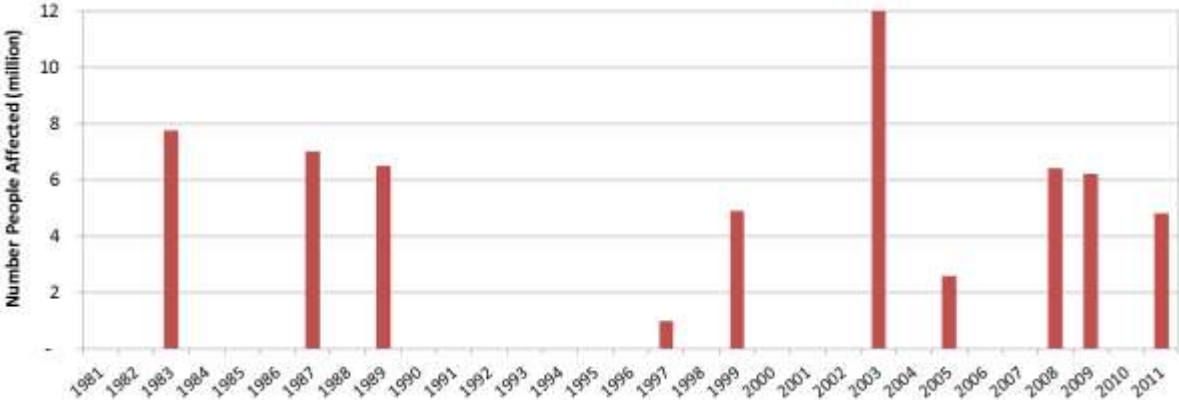


Legend



Source: Plots produced by Strategy technical team, based on data from DRMFS

Frequency of droughts



Number of people affected

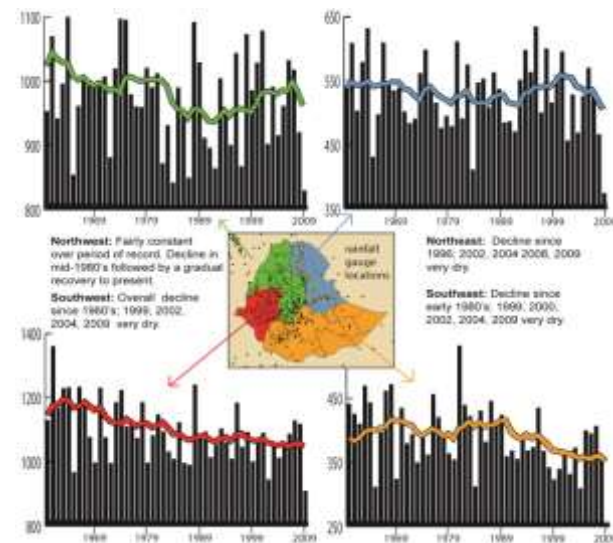
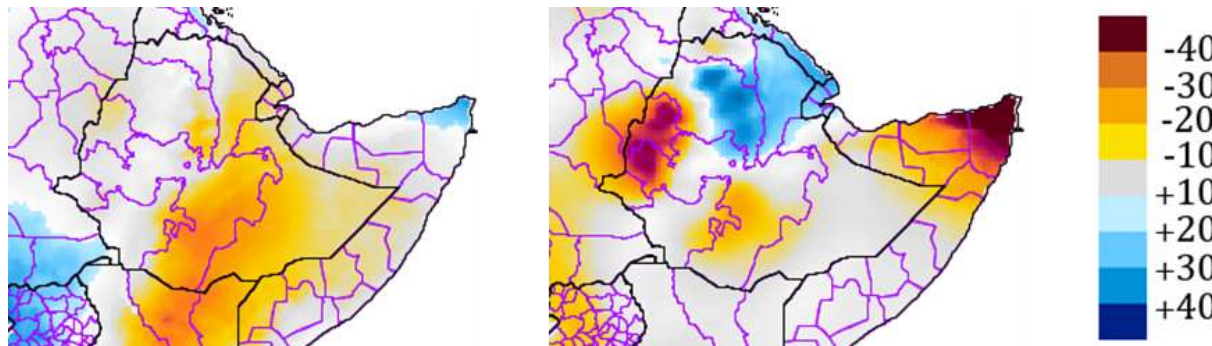
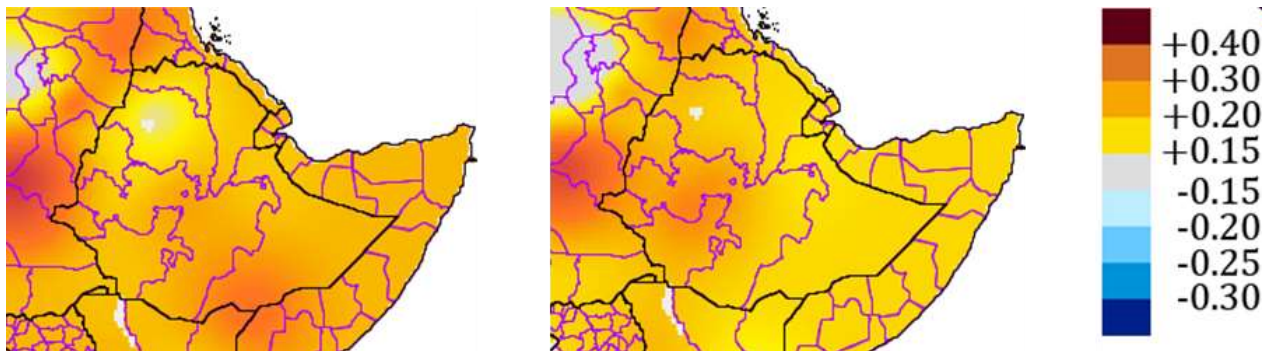
Source: EM-DAT

Identify key priorities today

- Analysis shows Ethiopia has a high existing adaptation deficit – around 1.5 – 2% equivalent of GDP today
- Arises from combination of periodic drought, floods, soil erosion
- Strong spatial patterns across the country
- But also existing policies in place

Climate Trend analysis

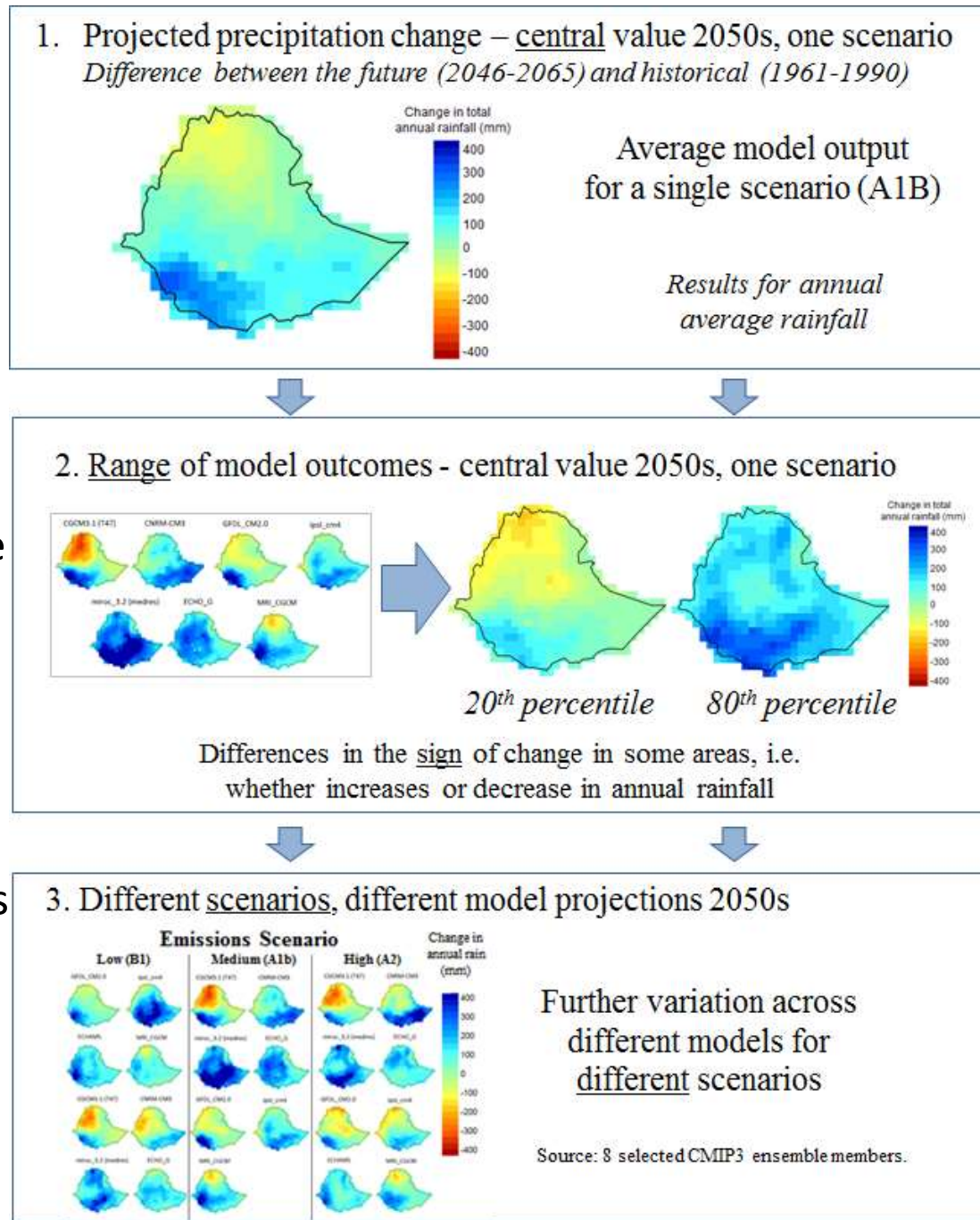
Climate is already changing – some indication of early focus



Source: courtesy of Chris Funk, FEWSNET, 2012.

Future with uncertainty

- High existing rainfall variability
- Long-term trends highly uncertainty and in many areas, not even agree on sign of change (+/-)
- No statistical confidence
- Drought and extreme projections very uncertain



1) 'No and Low Regret' Options

- No or low regret options address current climate variability and build future resilience
- Sometimes also called relation to win-win
- However, various use of term
- In mitigation literature, specific option that reduces greenhouse gas emissions while also leading to cost savings, e.g. energy efficient light bulb
- i.e. have a positive net present value (or positive benefit:cost ratio)
- Things we should do but don't (though often due to barriers, capital costs)
- In adaptation slight variations

Addressing climate variability – early adaptation

- Most of the options are variations of existing practice
- Capacity building
- Disaster Risk Management
- Good Development
- And less about hard coastal protection or mass water storage

Strategy Area 2. Build on existing good practice (no-regret and robust options)

Sub-sectors

Crop and water management on-farm (e.g. crop switching, smallholder irrigation)

	Crop switching and new varieties
	Fertiliser use
	Farm management and technology
	Pests and disease (including post-harvest losses)
	Irrigation
	Water infrastructure, allocation and transfers

Livestock

	General animal and value chain improvements
	Herd diversification
	Breeding programmes
	Improved animal health
	Fodder and feed improvement and resilience
	Rangeland rehabilitation and management
	Resilient animal housing

Sustainable agriculture and land management (SWC, SLM, climate smart)

	Conservation agriculture (zero or low tillage, cover crops, crop residues)
	Soil and water conservation (SWC) structures
	SWC cover crops
	SWC water harvesting (tied ridges, RWH, local structures).
	Soil management
	Agroforestry.

Forestry, conservation and biodiversity (including ecosystem based adaptation)

	Resilience measures for forests
	Conservation and rehabilitation
	Promoting biodiversity in agriculture
	Payment of ecosystem services

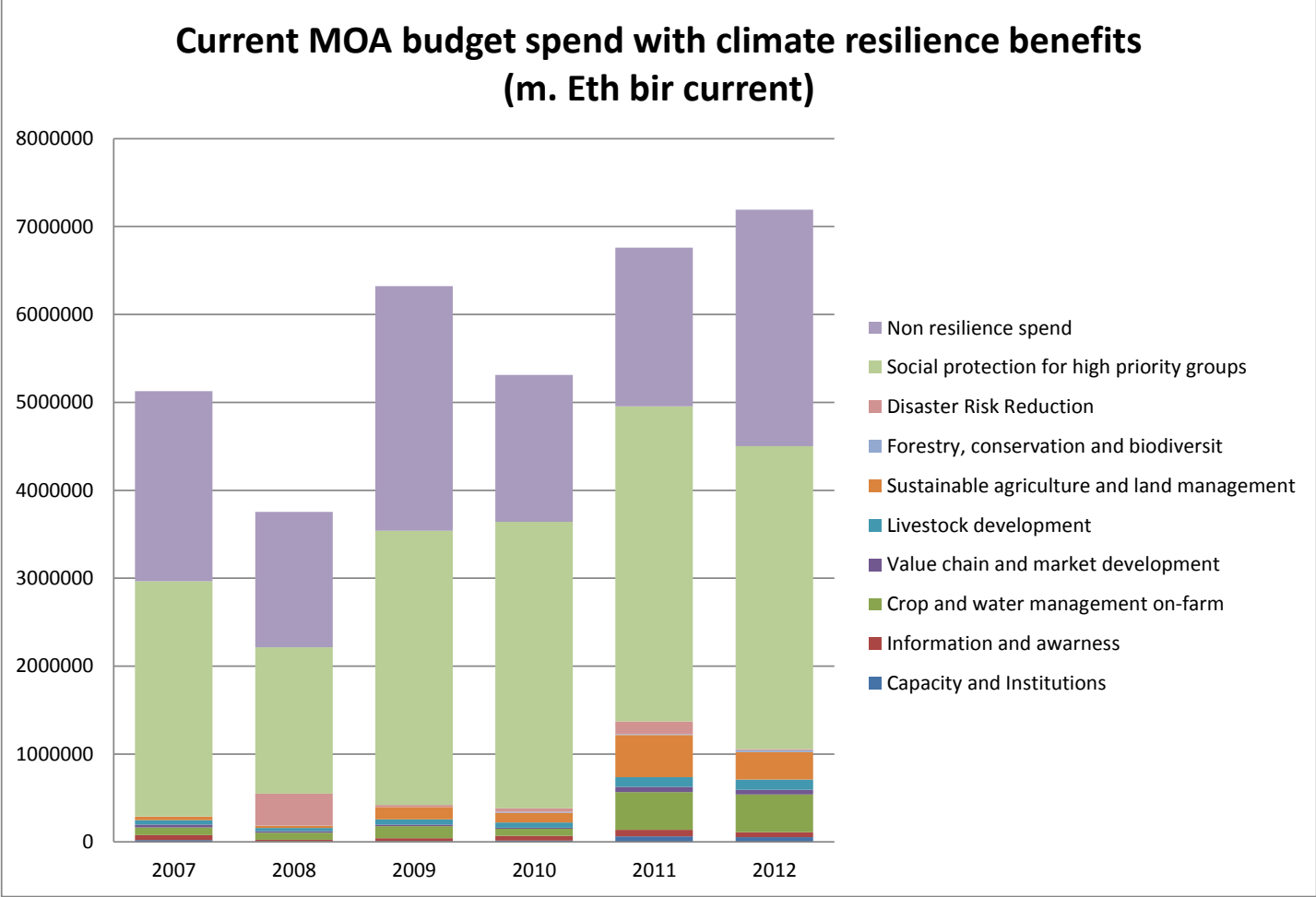
Low Regret options – do now

Often align with existing policy – so mainstream

Aligning to policy

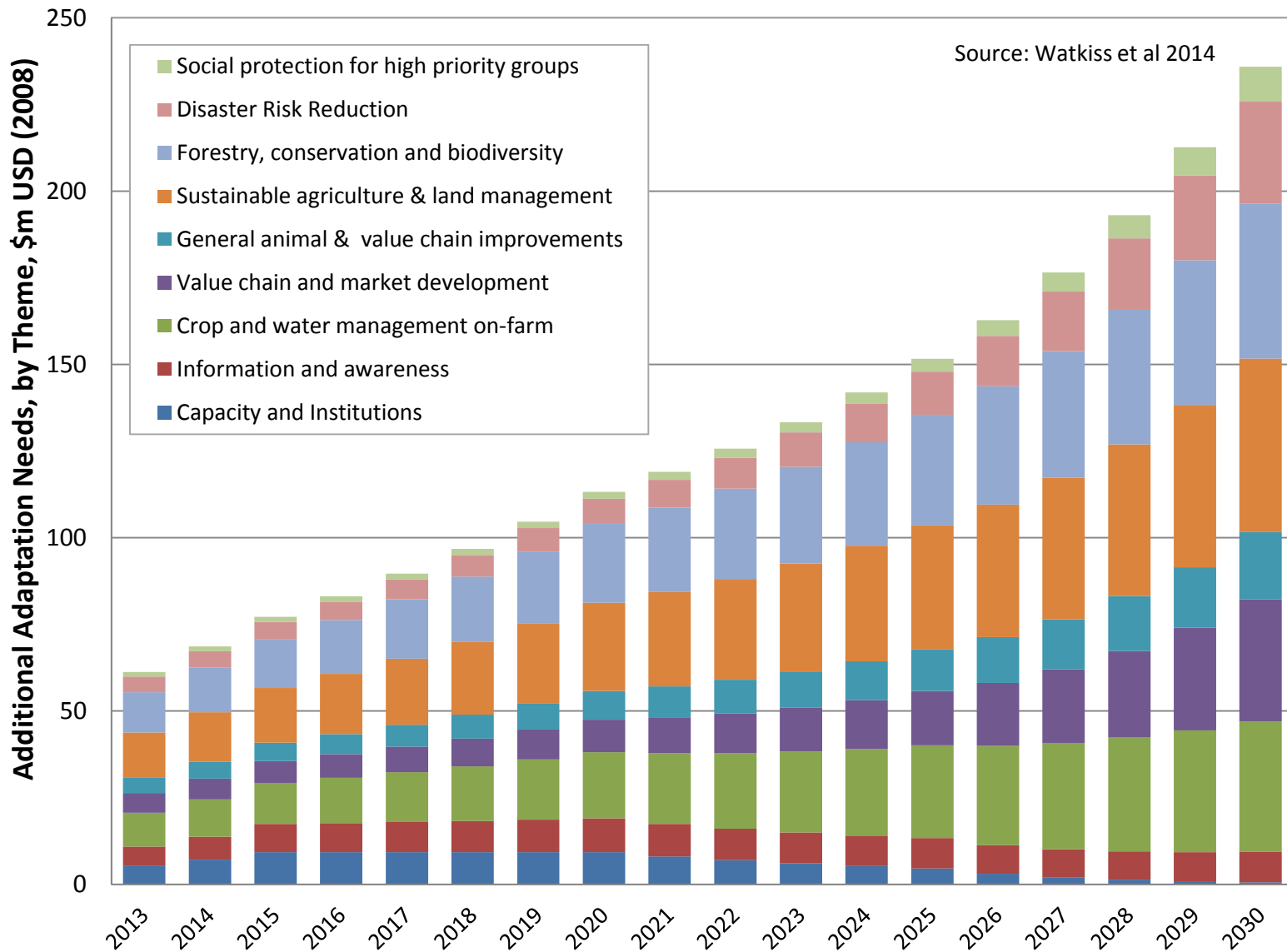
- In most countries, already some policies to address existing risks (even if not labelled as climate change)
- The focus on low-regrets therefore has strong overlap with development policy and sector plans
- Real adaptation has to take account of these – to avoid duplication
- Also likely that implementation route will be through existing departments and governance if moving beyond individual projects

Baseline investment: Historic profiling



Around 63% of current expenditure in resilient relevant activities, i.e. in addressing the existing adaptation deficit

Policy Appraisal - Ethiopia Climate Resilience Strategy

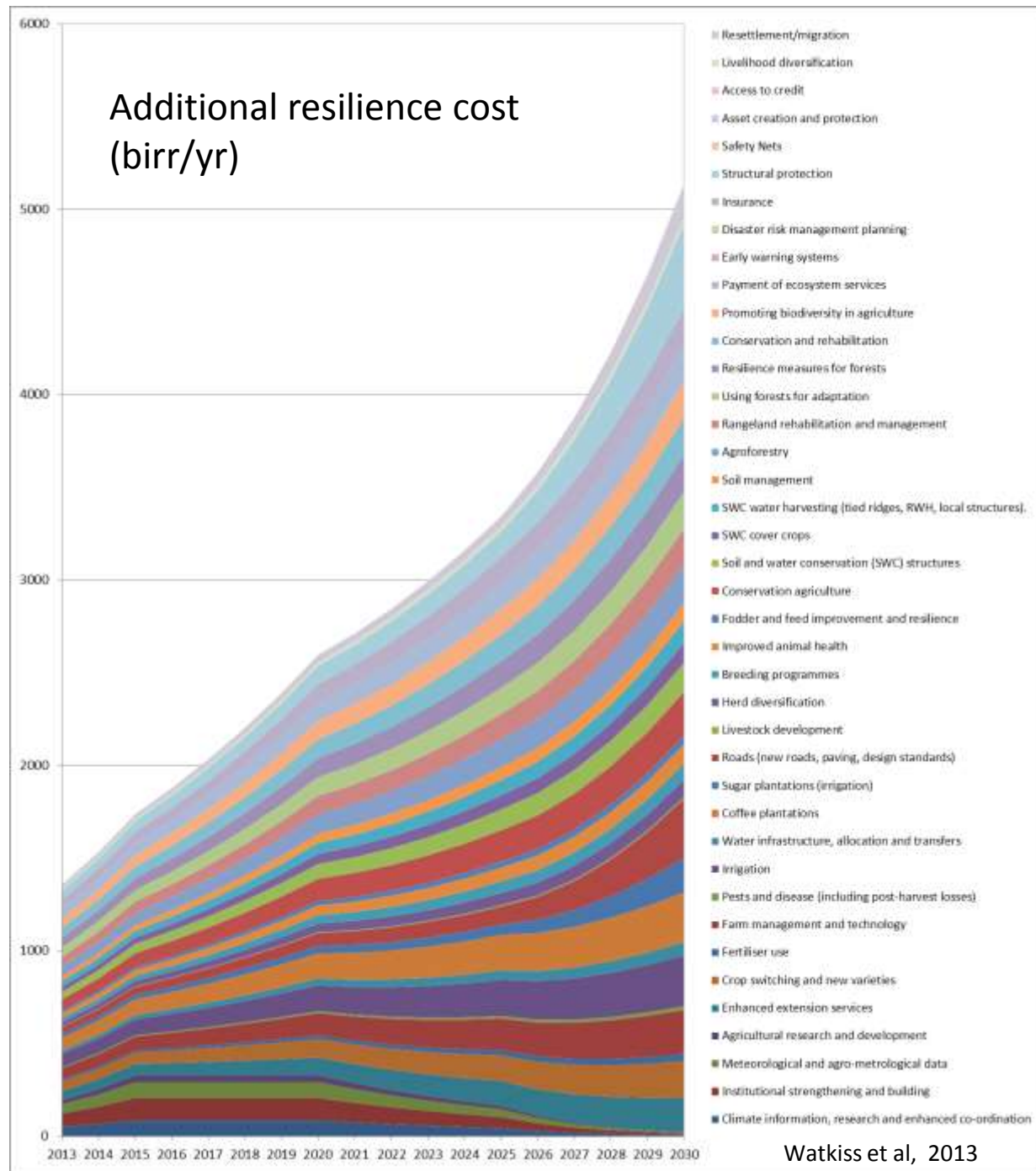


Ethiopia

Estimated additional investment for adaptation for

- Capacity building
- Mainstreaming
- Early long-term planning

Developing programmatic mainstreaming for each area – additional level of detail



Potentially major long-term risks

But cannot ignore future risks

Possible futures that by 2050 could lead to major economic cost, affect millions of people, lead to irreversible losses, etc.

Develop iterative plans



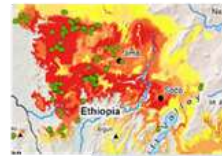
Crop Production

Major risks to self sufficiency and productivity from reductions in yield (20%) by 2050 from combination of hot and dry scenarios, extremes, wider factors, leading to effects on prices, food security, etc.



Land and soil degradation

Major increases in land and soil degradation, from combination of increase rainfall (some scenarios) and heavy precipitation increases, and/or lower water in dryland areas., increasing current high % agriculture GDP impacts



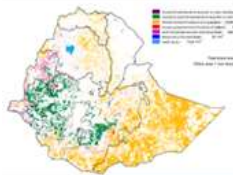
Coffee

Major risks to productivity and exports from reductions in yield/quality, changes, arising from some or all of temperature tolerance exceedences, precipitation changes, extremes, pest and disease



Water demand and irrigated crops

Major risks to growth from water gap (e.g. 2050 dry scenarios, major droughts) affecting planned agricultural development, including sugar plantations and cash crops.



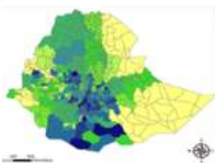
Bioclimatic envelopes for forests

Major risk to sustainable management of forests and ecosystem services from shifts beyond the limits of species tolerance. Major forest health collapse. Loss of supporting natural resources and ecosystem services.



Livelihood and social protection

Major risk to disaster risk management and food security objectives from changes in severity of frequency of drought and floods, beyond the limits of current coping capacity. Beyond resilience limits for pastoralists

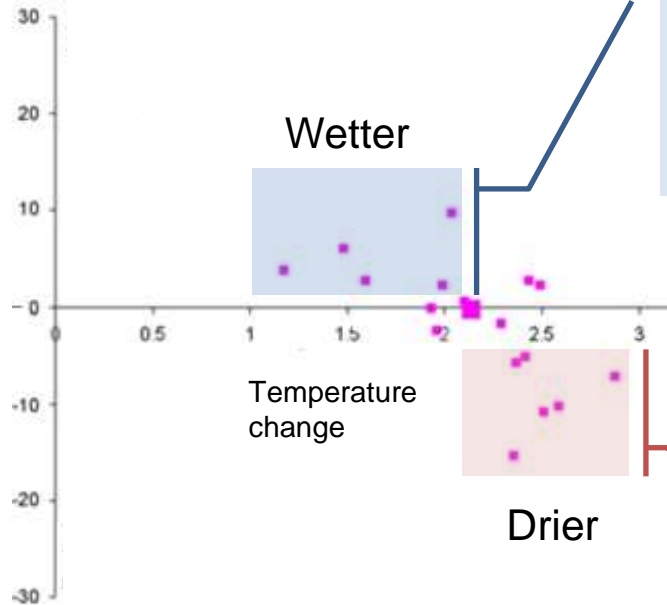


Livestock

Major risks to livestock, both pastoralist and for farmers from combination of heat, climate variability, pests and diseases

Long-term future risks

Average Precipitation change



Modest changes or even benefits, an increase in cereal yields could increase agricultural GDP by 1% by 2050, though current vulnerability remains

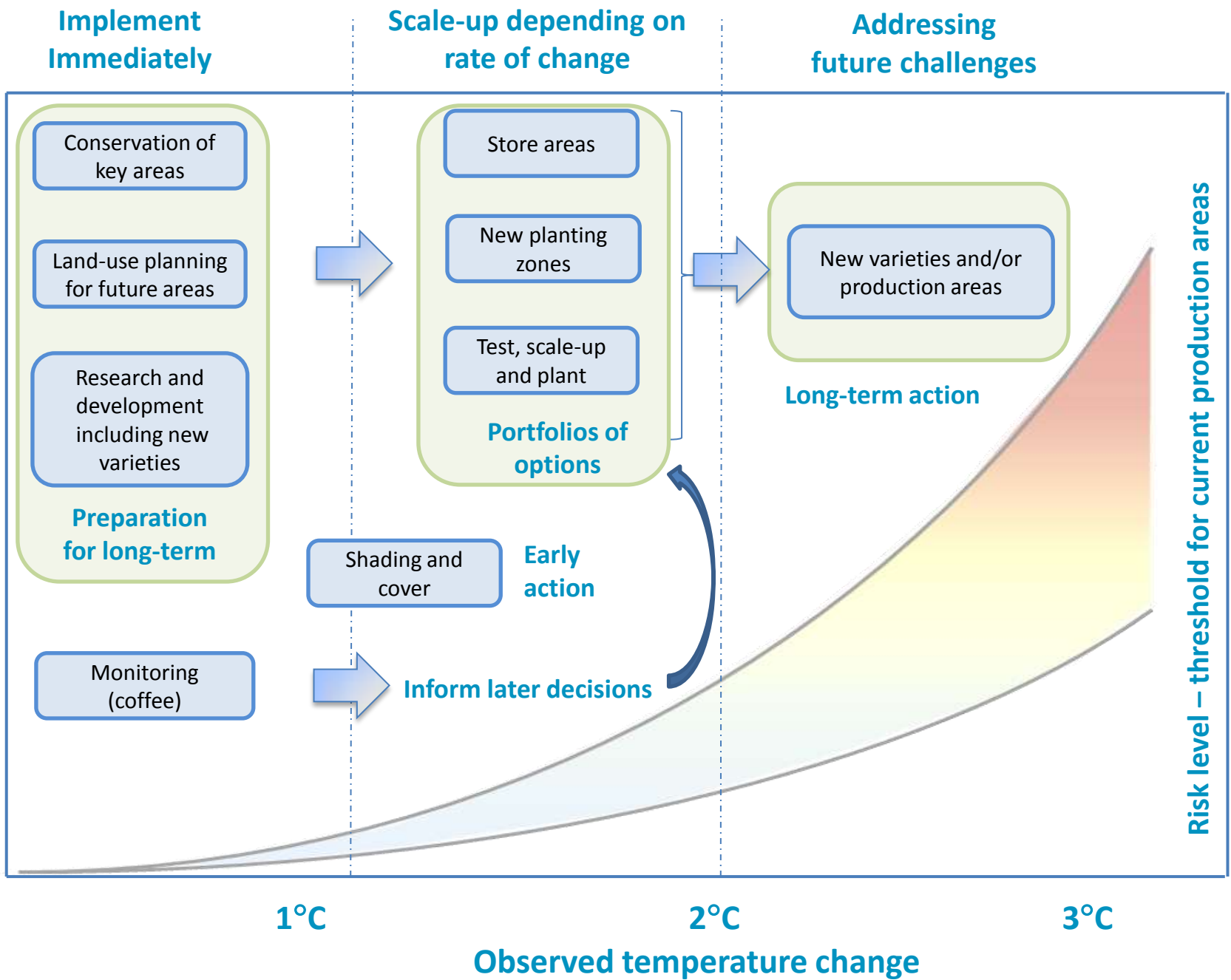
However, increases in extremes (floods) could lead to highly negative scenarios.

Large impacts - decreases in cereal yields could reduce agricultural GDP by 3% or more by 2050.

GDP per capita could fall by 30% from the effects on agriculture and livestock by 2050.

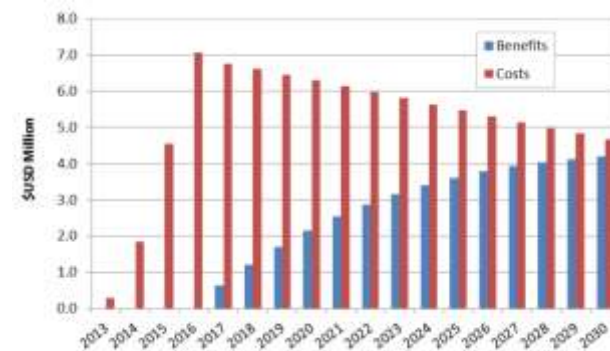
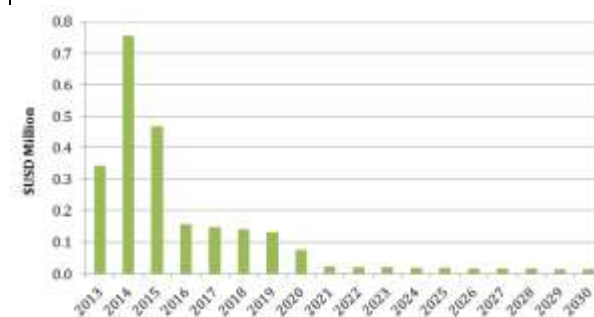
Long-term pathways

- Example of coffee
- Varieties in Ethiopia are climate sensitive
- Climate change could lead to major reductions in climatic shifts such that areas suitable for production major impacts, especially under high rates of change
- But adaptation responses take time, e.g. to develop and plant new varieties
- Adaptation pathway linked to improving evidence, monitoring, starting research and keeping options open



Long-term pathways – action and investment plans

Option	Adaptation measure (timeframe in years)	Scope
National surveillance		
Technical forestry measures	Developing database and monitoring/ surveillance system of forest resources and forestry-related projects	15 Million ha of high forest and woodlands
	Collection of quantitative and qualitative forest data; development of forest resources database	Survey and inventory on high forest and woodlands
	Establish permanent monitoring plots in representative forest/woodland types, for time series data	1 permanent plot of > 2 ha per vegetation type (11)
Management activities	Establishing data base centre with expertise and access to forest information, facilitate planning in forestry	One focal institute selected
	Developing participatory forest monitoring systems where communities are engaged	1.5 million households mobilized and organized
Political/ institutional	Political process for generating support for a inventory of existing forests	Federal level
	Supporting forestry education/training	5 Universities with NRM program supported
Expanding plantation forests with temperature tolerant species		
Technical forestry measures	Establishing planted forests with species that adapt well to future climate (high temperature, low rainfall)	1.5 Million new plantation established (75000ha/yr)
	Species selection for each AEZs that fits future climate	At least 5 species/AEZ
	Nursery development	1100 (two per district)
	Seed procurement	5 tree species/AEZ
	Seedling production	
	Establish planted forests on degraded and sloping lands	1.5 M ha in 20 years
	Plantation tending	1.5 M ha stand, planting, etc
Management activities	Developing forest management plan	1 national management
	Regional seed store establishment (see above)	As above
	Budget allocated for nursery and plantation	9 regional state affected
	Forestry education support including training of rangers	3 universities/10 TVET
Political/ institutional	National guideline on fast growing exotic species	Federal / regional gov.
	Forestry research support specially to establish breeding and selection programmes	
	Improving tree/forest tenure and encouraging private sector-community participation	





Building Resilience in Rwanda's tea and coffee sectors

Case study

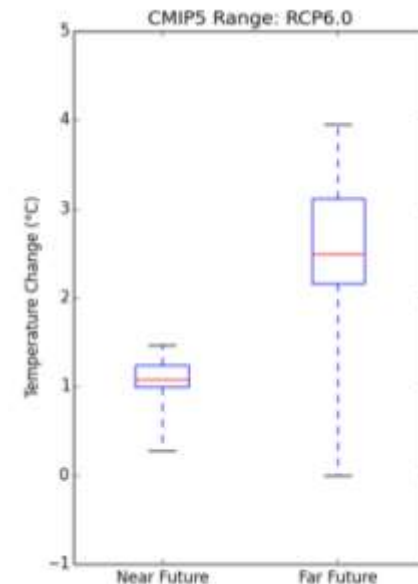
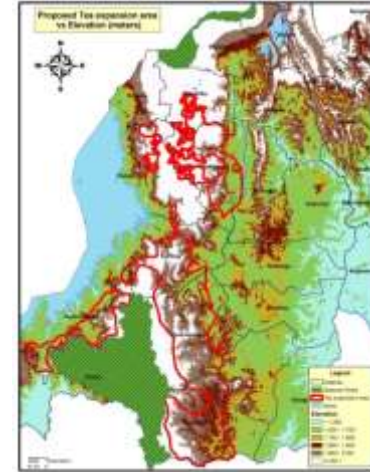
- Project on mainstreaming climate change into agricultural development
- Undertake for Ministry of Agriculture
- Focused on tea and coffee pilot study
- In final design phase and using economics to help select options and justify project

Mainstreaming into agriculture

- Mainstreaming into agriculture sector
- Mainstreaming entry point = **Agriculture Sector Investment Plan (ASIP2)**
- Planning document that sets out the strategic programmes of action to deliver agricultural growth strategy, with activities and indicators and budgets
- Aligned this project to ASIP objectives (climate smarting)
- Mainstreaming project started with a pilot study – tea and coffee
- Tea and coffee are 20% of total exports by value from Rwanda - grown at higher altitude as produces higher quality and higher prices for exports
- Key source of export growth in the national development plan. Plans to expand production area, e.g. doubling of tea area

Thinking about risks iteratively

- Tea and coffee are climate sensitive crops
- Current climate variability has high impacts today - changes in temperature and precipitation (20% lower in dry years)
- Prevalence of pests and disease highly climate sensitive – correlated incidence with higher temperature regions
- Expansion plans - but based on climate of today – higher temperatures involve large climatic shifts
- Critical given long life time (15 yr payback, decades)
- Future high risks but high uncertainty – lack of information



Responding iteratively with adaptation

- Select a set of adaptation response to address the various risks and decisions
1. Early low regret options to address climate problems today
 - Cover crops, shade trees, intercropping, capacity
 2. Addressing early decisions – climate smart planning
 - Risk mapping, use in expansion outreach programmes
 3. Starting research, monitoring and planning for future risks
 - Scaling up monitoring, new varieties, piloting, learning
- Aligned within the sector development objectives and current plans



Iterative adaptation economics

- Iterative analysis
 1. Identify & evaluate low regret options (early resilience, immediate benefits)
 2. Ensure that investments with long lifetimes (or leading to irreversibility) to be taken in near term are flexible and/or robust to future climate uncertainties
 3. Where awareness of potential climate risks exists but capacity to respond does not, explore investing in e.g. information provision

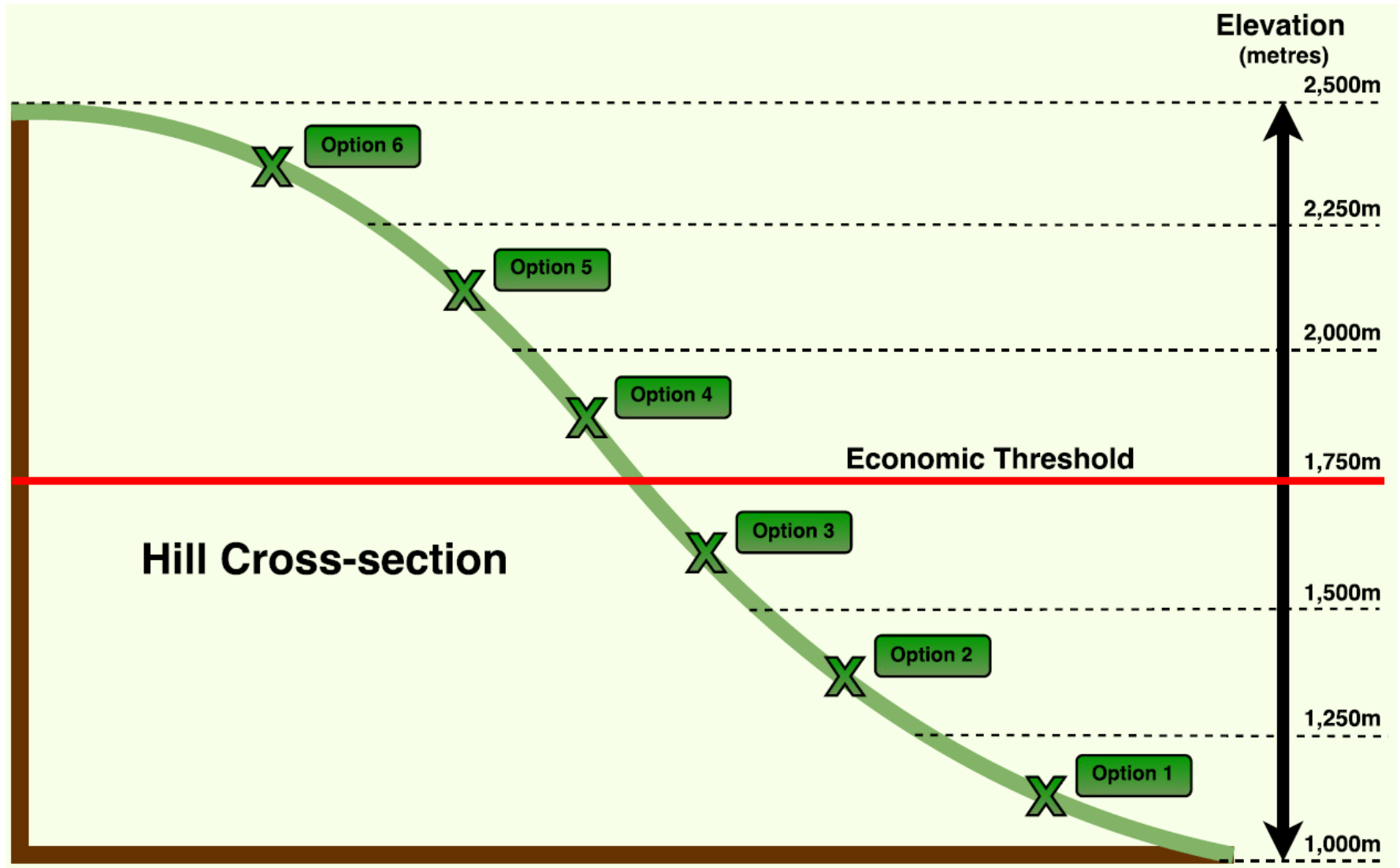
Economic appraisal of low regrets

- Conventional benefit-cost analysis adopted, using multiple future climate scenarios (robust decision making)
- Study prioritised climate smart agriculture options that addressed current climate variability as well as future change (mulching, cover crops, shade trees, intercropping)
 - Initial analysis showed positive benefit-cost ratios in baseline, and ratios increased under CC
 - Updating with context specific benefit-cost information (avoid benefit-transfer method) and improved scenarios
- “Soft” (non-technical options), e.g. farmer field schools for implementation that enhance effectiveness of smart options also being analysed

Economic appraisal of near-term decisions

- Current focus of research: tea expansion – where to expand new plantations?
 - Elevation critical for tea yield and quality
 - Portfolio analysis and decision making under uncertainty
- Planting options considered against criteria of economic efficiency and robustness, using non-probabilistic, dynamic, version of portfolio analysis
 - Considering opportunity costs of appropriating land, benefits of yield-quality mixes, economics of delay in planting, social risk preferences
- Used rule based criteria to determine economic thresholds for tea production under current and future climate e.g. areas that suitable under current climate (1700 – 1900m) may be ruled out

Tea expansion: Spatial options



Economic appraisal of better information

- Current focus of research: integrated pest (and disease) management for coffee
 - Monitoring and surveillance investment – learn about current and future anticipated pest and disease risks, develop GIS risk mapping
 - Focus on climate sensitive pests and diseases (coffee berry borer, coffee leaf rust, others?) and model changes in incidence under scenarios
 - Response strategies – combination of options that are robust over a number of future climate scenarios (resistant varieties, organic/inorganic pesticides/fungicides, good agricultural practices, traps)
- Value of information and ROA literature to inform approach