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EDITORIAL

European policy responses to climate change: progress on mainstreaming emissions reduction and adaptation

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Introduction to the special issue: mainstreaming climate into European Policy

Climate policy 'mainstreaming', 'proofing' and 'integration' are concepts that frequently appear in a range of EU policy discussions, most importantly in EU energy and climate policy (European Council 2014) and adaptation policy (EC 2013). They reflect the view that all EU policy sectors need to play a part in both reducing emissions and increasing resilience to unavoidable climate impacts. Broadly defined, mainstreaming refers to the inclusion of climate considerations in policy processes, improving the consistency among policy objectives, and where necessary, giving priority to climate-related goals above others. Although often couched in technical language, profound political challenges, at multiple levels of governance, lie at the heart of the mainstreaming agenda.

This special issue surveys how climate change has been mainstreamed into European Union sectoral policies and analyses its impacts on achieving European policy goals. The integration of climate change across policies has been an objective of European policymakers for over a decade. This is justified by the comprehensive long-term changes to energy systems required to achieve European decarbonisation targets and the scale of potential climate change impacts affecting policy domains in which significant competences lie with the EU.

The EU-funded RESPONSES project (2010–2013) analysed to what extent adaptation and mitigation have been mainstreamed in EU policies—focusing on policies related to flood and drought risk, biodiversity, regional policy, human health and electricity—and assessed the potential opportunities and limitations. In this introductory paper to the special issue, we provide an overview of the main findings of the project and draw general policy conclusions.

The main contribution of the project was to develop a common approach for assessing mainstreaming of emissions reduction and climate resilience across different policy sectors. Overall, we find that while the goal to reduce greenhouse gas emissions has been deeply integrated into EU sectoral policies, adaptation to climate variability and change impacts is much less well embedded. This appears to be due to the much lower political salience of adaptation to climate change, framed as adjustments to existing policy instruments so as to satisfy current political objectives in specific domains. No profound change appears to be needed, and a technocratic policy response

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appears to suffice. In addition, adaptation faces an incentive problem. Climate adaptation has been viewed as an implementation problem in EU policy, mostly at the local scale. Thus, policy efforts have focused on the provision of information and guidance to decision-makers at lower governance levels. This paper provides a synthesis of findings on mainstreaming climate mitigation and adaptation in five EU policy areas (flood and drought risk management, biodiversity protection, regional policy, health and energy) and a critical analysis of prospects to deepen mainstreaming. On adaptation, we conclude that the prospects for a strong EU role are likely to remain limited.

Mainstreaming as adjustments within a policy frame

There is no one-size-fits-all approach for mainstreaming climate into EU policies. This is partly because policy fields differ in nature and scope. For instance, EU agricultural and cohesion policies are primarily *distributive* in that they allocate funds to farmers and regions, while biodiversity and water policies are *regulative* in that they set rules and standards. Beyond this, EU policies operate over different temporal and spatial scales. For example, the farm is the relevant spatial unit for agriculture policy, while the river basin is at the core of water policy. Moreover, EU policies employ different sets of policy instruments and measures. Finally, the potential for reducing greenhouse gas emissions or vulnerability to climate change impacts varies greatly between sectors. While flood and drought are critical risks for water policy, extreme heat and vector-borne disease are key risks for health. These particularities, as well as the political relations which determine each of them, are the messy and complex context within which climate mainstreaming unfolds.

Increasingly, cross-sectoral integration across policy domains has played a role in achieving environmental and climate goals (Lenschow 2002; Lafferty and Hovden 2003; Jordan and Lenschow 2010). Drawing on previous experience with ‘environmental policy integration’ (EPI) in the EU, scholars have suggested a number of factors explaining success and failure in climate policy mainstreaming. Important insights are summarised in Table 1. Overall, mainstreaming is more likely to be successful in influencing policies where shared sense of climate risks, high-level political commitment, cross-sectoral coordinating institutions, ‘hard’ instruments (like mandates) are in place and ‘win–win’ opportunities are available between climate-related and other policy goals. While many of these conditions have existed in various parts of EU policy, the seriousness with which mainstreaming is pursued is currently highly variable, across sectors and jurisdictions.

An example of the complexity of the relationship between EU policy and vulnerability and adaptation measures is given in Fig. 1. This shows a range of on- and off-farm measures relevant to flood and drought risk reduction—important adaptation measures in the water and agriculture sectors—and how these are supported through EU water, agriculture and biodiversity policies. Through this web of relationships, EU policies can combine to build climate resilience in the face of the linked threats of flooding and drought. This complexity is both a source of strength, since it offers resilience in responses, and also a source of potential weakness, as it makes climate adaptation hard to ‘see’ and measure. Opportunities for mainstreaming to build climate resilience may therefore go unexploited. Cross-sectoral linkages appear to be fundamental to achieving effective adaptation at a European scale, a ‘second-order’ form of mainstreaming not currently accounted for in policy action and appraisal.

Managing flood and drought risks under climate change

The costs of floods and droughts continue to rise in the European Union, despite centuries of investments in levees, reservoirs and other infrastructure (OECD 2010; EEA 2013). These growing costs can be attributed to climate change to a very limited extent, but cannot yet be linked to anthropogenic emissions (Bouwer 2011). Yet climate projections suggest significant changes in future risk across the EU (Kovats et al. 2014). This prospect adds to the need for investing in drought and flood risk management today as a way of preparing for future climates and patterns of risk. Where possible, such investments should also aim to reduce greenhouse gas emissions. We examined the potential and challenges for mainstreaming climate into EU water and agriculture policies influencing flood and drought risks, focusing on a case study in the Warta river basin of Poland (Bayer et al. 2015).

The EU has a comprehensive portfolio of policies directly and indirectly addressing flood and drought risk. The most important are the: EU Common Agricultural Policy (CAP); EU Water Framework Directive (WFD); EU Floods Directive (FD); EU Water Scarcity and Droughts Strategy (WSDS); and Structural and Cohesion Funds. There are many examples of flood and drought risk adaptation measures, with links to mitigation, mainstreamed into EU policies. For instance, the WFD and FD require flood and drought risk management plans and flood risk assessments that take climate change into account, although without specific targets. While CAP does not directly address flood and drought risks, the 2013 CAP reforms present opportunities for mainstreaming. For

Table 1 Overview of factors influencing climate policy mainstreaming (Based on Hey 2002; Larsen and Kørnøv 2009; Pollack and Hafner-Burton 2010; Persson 2004, Pittock 2011)

Types of explanation	Factors explaining success of mainstreaming
Knowledge related	Experience and perceived seriousness of climate impacts
	Expert consensus about future climate impacts
Institution related	Degree of high-level political commitment to climate goals
	Existence of venues allowing coordination between sectors
	A capacity to regulate
	A balance of power and resources between environmental/climate regulators and other policy sectors
Instrument related	'Hard' incentives (rather than 'soft' incentives) to stimulate mainstreaming
External factors/synergies	Timing/sequencing of relevant policy processes
	Potential for technological win–win solutions
	Policy developments in the target sector coincide with a climate agenda

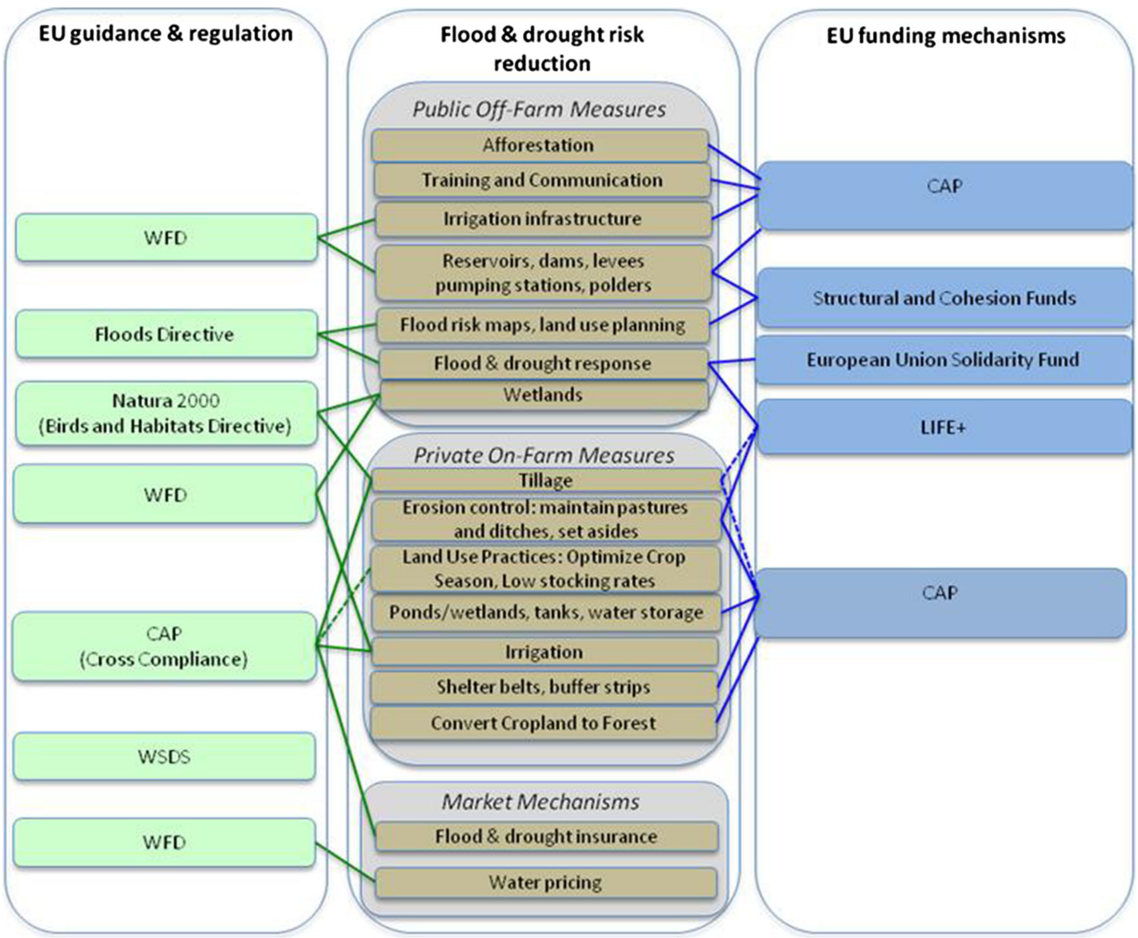

Fig. 1 EU policies for reducing flood and drought risks: a complex interaction

instance, the CAP cross-compliance regulations can require on-farm measures, such as soil management plans, constructing small retention ponds, planting shelter belts that reduce runoff and changing tillage practices to hold moisture in the soil. These measures not only reduce flooding downstream and provide water in time of drought, but also contribute to mitigation by improving carbon sinks. CAP's agri-environment programme (AEP) compensates farmers for making on-farm water retention and other investments. Off-farm measures, such as large reservoirs, are eligible for co-funding from the European Agriculture Fund for Rural Development (EAFRD) and Structural and Cohesion Funds. As yet, however, these programmes have not been linked in a unified EU policy for flood and drought risk management. EU policies therefore provide a diverse but poorly linked framework for mainstreaming flood and drought risk management in agriculture and water policies.

Protecting European biodiversity in a transient climate

While reaching the EU goal of halting biodiversity loss by 2020 is already difficult, climate change adds to this challenge. As climate changes, localities change in suitability and may become unsuitable to species occurring there today. This can not only lead to reductions and shifts in species distributions, but also breaks in important ecological interactions—increasing extinction risk of species and jeopardising vital ecosystem services, such as pollination.

Van Teeffelen et al. (this issue) briefly review observed and projected impacts of climate change for biodiversity. Araújo et al. (2011) specifically explored the expected impact of climate change on the main EU biodiversity policy outcome, the Natura 2000 network, and its terrestrial vertebrate and plant species of conservation concern. They find that climate change can undermine past conservation successes when protected areas become climatically unsuitable for the species they were supposed to protect. They conclude that there is a high risk that ongoing efforts to conserve Europe's biodiversity are jeopardised by climate change. Mitigation of climate change attenuates impacts, but the conservation of EU's biodiversity will require policy amendments and approaches beyond those currently in place.

Meller et al. (2014) addressed the interaction between mitigation strategies (increases in bioenergy production) and their direct and indirect impacts on biodiversity. A two-degree world with extensive use of bioenergy does have impacts for biodiversity, but the combined impacts from climatic change and land-use change in such a world are less than the impacts in a four-degree world with minor bioenergy use. Their conclusions are based on an assessment for bird species in the EU, not considering biodiversity impacts of the large share of bioenergy imported.

In terms of adaptation, an important issue for policy-makers is to establish to what degree current EU biodiversity policy can already address climate change-related challenges and where are the important gaps. Van Teeffelen et al. (this issue) carried out such an assessment. First, they highlight gaps in the set of adaptation options as put forward by science, which does not address all impacts from climate change on biodiversity, but primarily focusses on shifts in species distributions (See Fig. 2). Second, they assessed the degree to which the different adaptation options are accommodated by current EU biodiversity policy. They conclude that EU biodiversity policy generally supports, and even requires, adaptation in multiple ways. Substantial obstacles remain though, notably:

(1) There is a focus on patterns, and the Natura 2000 network is considered complete
While EU biodiversity legislation leaves room for proactively adapting to climate change, the currently narrow interpretation by most member states focuses on patterns rather than processes. Natura 2000 sites are designated for the occurrence of protected species and habitats. Nature is dynamic though, even more so under climate change. As the current Natura 2000 network is expected to be insufficiently robust to allow species to adapt to climate change (e.g. Araújo et al. 2011; Lung et al. 2014), extensions are necessary. This contrasts with the EU biodiversity strategy which states that the establishment of Natura 2000 should be largely complete by 2012 (European Commission 2011, action 1A to reach Target 1) and reflects the current static interpretation of the directives. Legally, extensions of the network are possible and even mandatory.

(2) Adaptation options are generic, and uptake is considered voluntary, risking a piecemeal approach
Several measures, like habitat restoration and ensuring coherence of reserve networks, are left at the discretion of the member states. Together with the fact that adaptation options are not specified for species, ecosystems or regional contexts, it is up to the member states, and sites managers, to identify and implement appropriate measures. This is also clear from the guidance on climate adaptation of the Natura 2000 network (European Commission 2013), which focuses mostly on the site managers to help them make individual Natura 2000 areas more robust given climate change. While measures have to be taken at the local level tailored to the specifics of sites and species, voluntary action and a lack of coordination may result in a piecemeal approach.

As a result of these two issues, an integrated European response is unlikely to emerge. Overall, there appears to be a lack of vision (or a hesitation to put this forward), leading to a shortage of guidance on where the network as a whole needs to be strengthened through conservation or restoration measures. The subsidiarity principle creates a certain trade-off between the large-scale vision needed and the individual responsibilities of member states (see, e.g. Ioja

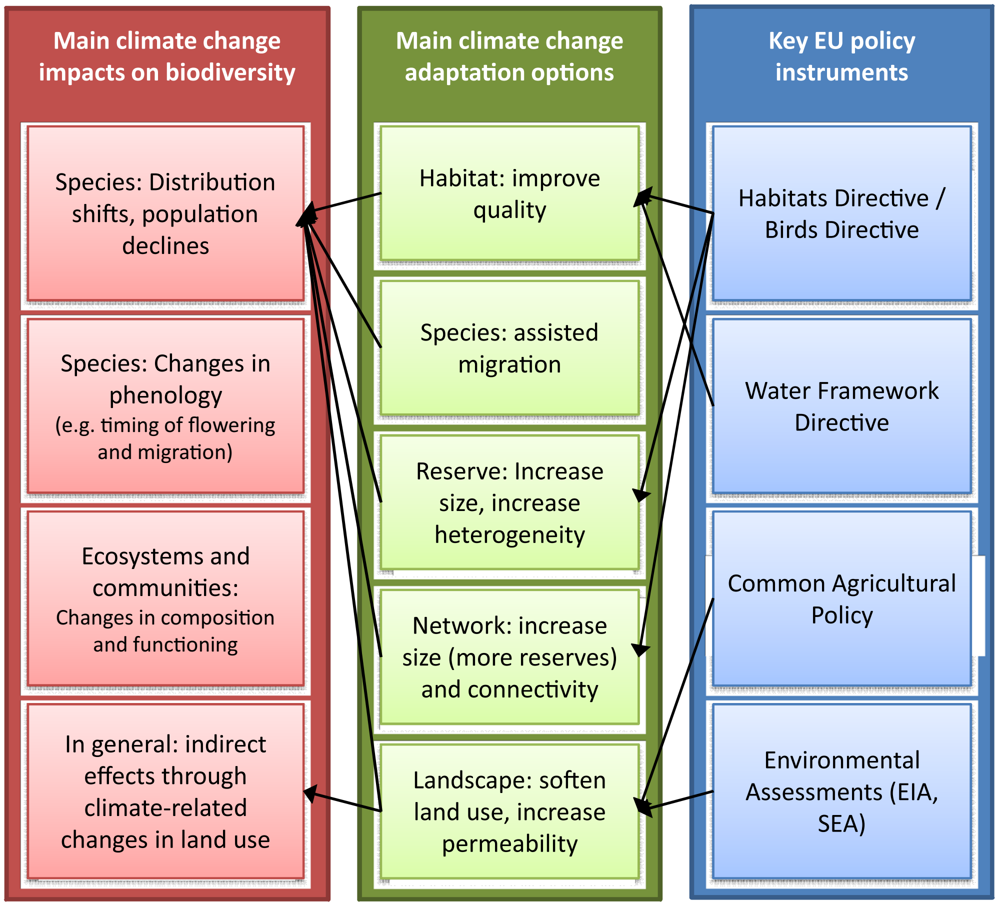

Fig. 2 Interactions between impacts of climate change on biodiversity, strategies to alleviate these impacts and EU policy instruments available today, to implement these strategies in practice (Van Teeffelen et al. 2011)

et al. 2010). Even so, the impacts of climate change require that measures taken locally complement one another and contribute to an adaptive, robust conservation approach at the large-scale level.

EU policy instruments such as LIFE(+) and the Structural and Cohesion Funds may be able to support this process. However, climate change adaptation has yet to be mainstreamed into guidelines or allocations of funding. Lung et al. (2014) found that current distribution of funds through these programmes better reflects the distribution of Natura 2000 sites, than the adaptation needs facing climate change. The present changes in the LIFE programme (for the period 2014–2020) include an allocation of the share of the funds through a separate sub-programme for climate action. This has the potential to support climate change mainstreaming to various policy sectors, if projects are carefully planned and implemented. However, such a division of LIFE budgets runs a risk of disconnecting climate change considerations from projects under the conventional environment sub-programme.

Building climate resilience through EU regional policy

EU regional and cohesion policy accounted for total expenditures of about Euro 50B per year in 2007–2013, some 36 % of total EU budget. These expenditures hold important potential for supporting climate change mitigation goals through investments in greenhouse gas emissions reductions, as well as funding climate resilience and reducing vulnerability. Given the redistributive nature of regional policy—supporting mostly the least developed European regions—the EU could address the unequal burden of required efforts and differences in capacities in facing climate change that exist across Europe.

In the RESPONSES project, we investigated whether expenditures of Structural and Cohesion Funds (SCF) were consistent with the occurrence and risks of key climate-related hazards across EU regions. The climate change impact assessment was based on indicators for heat stress (in relation to human health), river flooding and forest fire at a pan-European (NUTS 2) level (Lung et al. 2013a). Compared with the baseline situation, for the period 2041–2070, a strong increase in overall impacts is projected for almost all regions in southern Europe and France, as well as large parts of Germany, Czech Republic, Belgium and the Netherlands. In contrast, for Ireland, Scandinavia, much of Poland and the Baltic countries and most regions of the UK, overall impacts remain comparatively low. In an accompanying study, Lung et al. (2013b) show that the uncertainties in estimated impacts, with an important role for differences in projections from global and regional climate models, are highest for flood risks that are precipitation dependent, compared with heat wave and forest fire risks that are more temperature dependent.

Vulnerability hotspots were defined for heat stress, river flood risk and forest fire risk and were compared to patterns of adaptive capacities based on current human, financial and technical capital. For the future scenario for 2041–2070, there is a projected increase in the number of potentially most vulnerable regions, assuming adaptive capacity remains unchanged at current levels. New hotspot regions would be in Bulgaria, Romania, Czech Republic, Poland, and France, while other regions are projected to turn into 'more severe' hotspots, such as southern Romania and northern Bulgaria or (north)-eastern Germany (see Fig. 3). Strengthening the adaptive

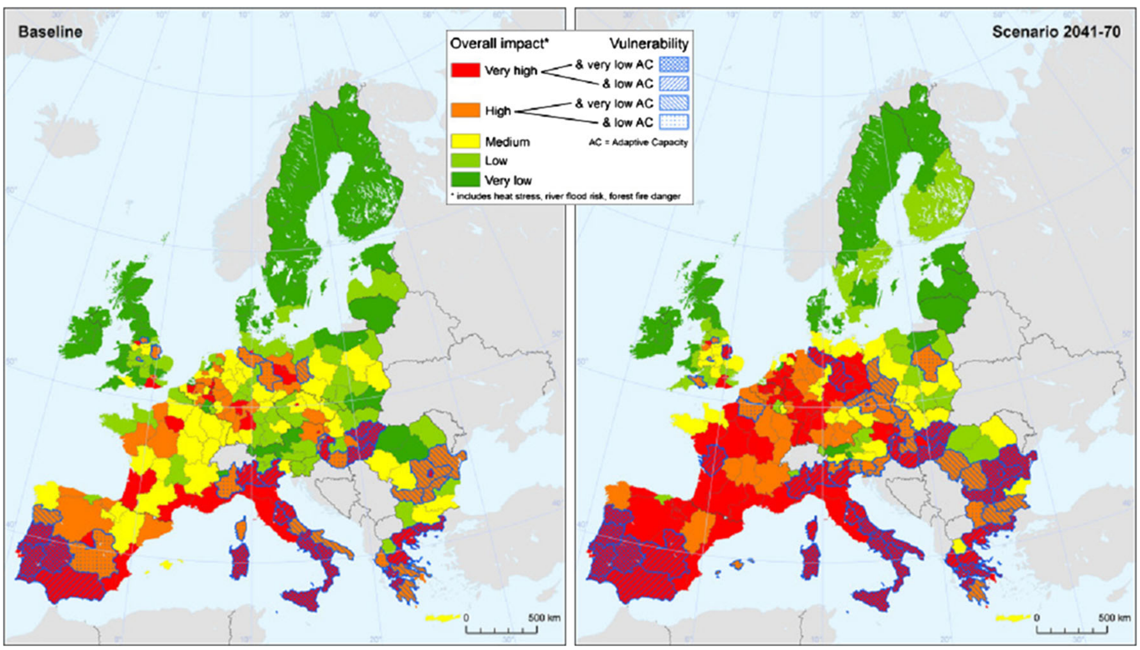

Fig. 3 Overall change in climate impacts and adaptive capacity across the EU (present day (*left*) and 2041–2070 (*right*) Source: Lung et al. 2013a

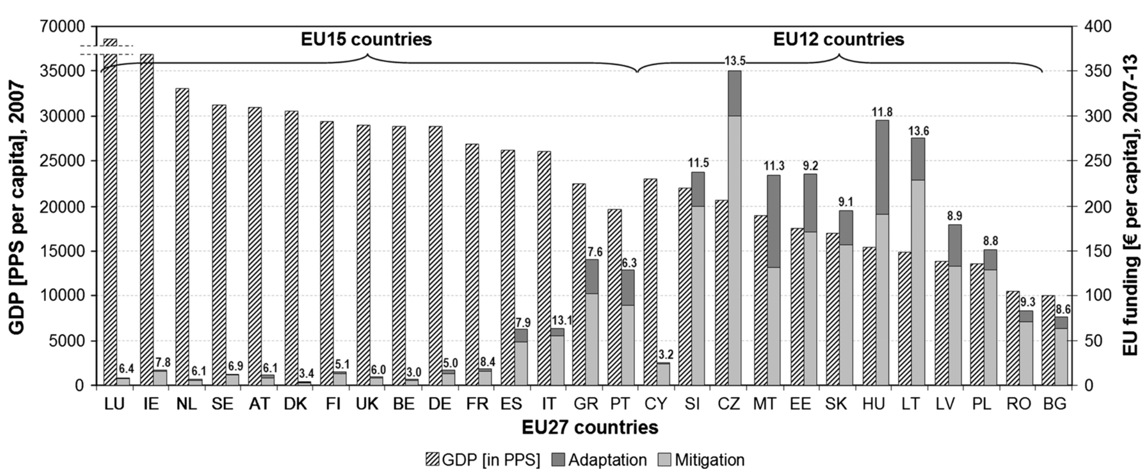

Fig. 4 Allocations for thematic priorities relevant for mitigation and adaptation (*right bars*) in the EU Structural and Cohesion Funds and income levels (GDP) (*left bars*) in the EU-27 (Hanger et al. this issue)

capacity of vulnerable groups and sectors in these regions would alter these patterns.

Within European regional policy, more effort has been devoted to mainstream mitigation concerns than adaptation goals. A systematic review of member states' strategic planning documents shows that references to mitigation are quite common in the 2007–2013 funding period (Hanger et al., this issue). Much less attention is paid to issues related to vulnerability and adaptation (See Fig. 4). The focus on mitigation is also reflected in financial allocations, owing to the earmarking provisions for items under the Lisbon Agenda (2000, Hanger et al., this issue). Overall, climate change seems to be inconsistently integrated in funding allocations. Regarding adaptation, Hungary and Malta are exceptional, with considerable allocations made for relevant investments. On the whole, however, we find that the rhetoric displayed in high-level policy documents is not reflected in actual financial allocations. Additionally, many allocations sorted under adaptation are often justified as efforts to reduce natural hazard risks after major recent events. Adaptation action appears to be more driven by events than by a strategy of integration and mainstreaming.

Managing new climate-sensitive health threats in the EU

The role of the EU in improving public health is to complement national actions, especially where national authorities need to cooperate. Management of new disease threats requires international cooperation, with other agencies, such as the World Health Organisation (WHO), already playing a prominent role of health protection and promotion. Many vector-borne diseases, such as dengue fever, are not currently autochthonous in Europe but may become so under climate change.

Adverse health impacts of climate change may follow extreme weather events, especially drought, flooding and heat waves, or could be associated with gradual changes in the ecology of natural environments or biota. Based on a literature review, Bouzid and Hunter (2012) identified a list of high-priority diseases likely to pose a threat in Europe under a changing climate. For vector-borne diseases, these include West Nile fever, dengue fever, chikungunya fever, malaria, leishmaniasis, tick-borne encephalitis (TBE), lyme borreliosis, Crimean-Congo haemorrhagic fever (CCHF), spotted fever rickettsioses, yellow fever and Rift Valley fever. Waterborne diseases are also likely to be influenced by climate change. The risk to human health is associated with the contamination of drinking and recreational waters with waterborne bacteria, parasites and viruses. Another major health impact is associated with heat stress-related morbidity and mortality, which is considered an area of major direct impact because of the severity of the outcome (death) and increased political sensitivity. However, cold-related deaths currently outweigh heat-related deaths in the UK by at least an order of magnitude (Vardoulakis et al. 2014). Cold-related deaths are projected to decrease more markedly than heat-related deaths will increase this century, and both will be amplified by an ageing population. In summary, climate change is likely to allow expansion of the geographical distribution of vector-borne diseases or even emergence of new ones, increase prevalence of waterborne diseases and result in more extreme weather events, thus contributing to an increased disease burden.

An appraisal was conducted of the effectiveness of public health interventions directed at the climate-sensitive diseases through a systematic review of systematic reviews (Bouzid et al. 2013). No reviews were found for nine of 17 of the high-priority climate-sensitive diseases. Chemoprophylaxis (medication preventing disease) and immunization interventions were generally backed by good-quality evidence and showed high effectiveness. We consider that environmental and/or community-based interventions—such as removing mosquito-breeding sites or checking on vulnerable groups during heat waves—could have the most value in a warmer world, despite a lack of good-quality evidence to date. These interventions should be prioritised as climate adaptation options, while being sensitive to potential conflicts with objectives in other policy fields, such as the biodiversity impacts of draining wetlands.

Adaptation options depend on health services, including appropriate infrastructure and an efficient healthcare system. In addition, to ensure adequate responses to the health challenges caused by climate change, it is crucial that healthcare professionals receive appropriate and focused training. Other adaptation options include early detection, and disease management and prevention. The implementation of entomological and sentinel clinical surveillance networks (early detection of the mosquito vector and index of human cases) has proven to be valuable in identifying disease hotspots and in limiting disease spread when appropriate health responses (case isolation and treatment) are promptly implemented. For extreme weather events, appropriate infrastructure, accurate forecast and timely alerts for at-risk populations are likely to be the best adaptation and preparedness options. An example of this is heat–health warning systems (HHWS) currently implemented in several European countries.

Transforming electricity production in the EU

The electricity sector is fundamental to CO_2 emissions reductions in the EU. But it also needs to adapt to climate change and variability. The need for climate change adaptation in the electricity sector was investigated through a literature-based vulnerability analysis identifying the impacts of climate change on electricity supply and demand in the EU (Held et al. 2010). The impacts of climate change on the demand and supply side differ by European region (and over time), but are—in the main—limited in scope. Major findings on electricity supply are that hydropower, thermal and nuclear power technologies are most vulnerable. Hydropower, which depends on river flow regimes, is threatened by changed precipitation patterns. For thermal and nuclear plants, reduced availability of cooling water (from rivers) can increase the number of shutdowns and the costs for alternative cooling systems. In contrast, wind and solar power are less vulnerable. Especially in Southern Europe, electricity demand for cooling purposes is affected by climate change. Heat demand in winter is reduced for Europe as a whole, compensating for increased cooling needs (Labriet et al. 2013).

The electricity sector is critical to achieve deep emissions reductions in Europe. Under a new low-emission scenario for the EU (Deetman et al. 2013), which looked at specific policy measures across different sectors (that is, not assuming cost-optimal solutions with a carbon tax alone), a reduction of 34–43 % in total EU emissions by 2050 could be achieved in the power generation sector alone, with wind generation playing a major role. As this already implies a complete decarbonisation of the electricity sector, reduction measures in other sectors are also important to achieve the long-term EU climate targets. A high share of renewable energies is cost efficient in all scenarios analysed (Deetman et al. 2015). Realising this requires an extensive expansion of electricity grids. Few new large-scale electricity storage facilities will be needed. However, if the growth in electricity demand cannot be slowed down through effective energy efficiency measures, at least one additional low-carbon technology like Carbon capture and storage (CCS) or nuclear is necessary. If all the obstacles to CCS can be removed, it will become an important pillar of the decarbonisation strategy. In this case, CCS in combination with coal-based power will displace nuclear power almost completely. Without CCS, a more rapid growth in renewables would be required, and nuclear energy could become competitive again. Nevertheless, path dependencies require speedy decisions on the future technological mix regarding renewables, nuclear energy and CCS.

Reichardt et al. (2011) investigated policy support for a number of more novel technologies with significant mitigation potential: concentrated solar power (CSP), offshore wind, marine energy production (tidal and wave power) and CCS. The main findings suggest that although feed-in tariffs and renewable obligation certificates are major drivers in all innovation phases of the three renewable technologies, they are currently not sufficient for these technologies to develop successfully. Rather, further policy elements need to be in place, such as research, development and deployment funding, which can be tailored towards specific technologies. This kind of support is not consistently available in the EU, suggesting that the development of these technologies will be slow.

In summary, we find that EU energy and climate policy have consistently matched ambitious climate targets with a range of instruments designed to achieve greenhouse emissions reductions among large emitters in the electric power sector and, to a lesser extent, manufacturing industry. In the period after 2000, there was major policy innovation, including the introduction of the EU-wide Emissions Trading System (ETS). Evidence suggests that the ETS has reduced EU greenhouse gas emissions by 40–80 MT per year since it was introduced in 2005 (Laing et al. 2014), against total energy sector emissions reductions for the EU-25 of 448 MT over the same period (EEA 2014). Nor is there evidence that the ETS has served to stimulate innovation and investment in renewables and CCS—the two critical components of a low-carbon EU energy economy (Rogge et al. 2010). Rather, EU policy has served as the politico-legal framework within which quite unique national energy transitions have been set in motion.

Key decisions in the area of climate change mitigation are obviously taken outside Europe. The role of the USA, India and China is large, when it comes to actual potentials for global emissions reductions and possibilities to achieve the two-degree target set by the international community. The RESPONSES project explicitly included the assessment of mitigation scenarios from these key countries. Hof et al. (2015) analyse scenarios from India and China and find that compared with international studies, current emissions from these countries tend to be underestimated, but also that decarbonisation may pick up more rapidly according to national assessments. Similar uncertainties affect future emissions projects for the USA (Wilbanks and Wright 2012). Patchy mitigation effort at the state level is complemented by a host of policies at the Federal level (White House 2013) on regulating the power sector, renewables and transport, with the greatest opportunities in the power sector. Most US analysts currently believe a US emissions trajectory consistent with a global two-degree target is unlikely to be achieved.

Conclusions

Our review of climate mainstreaming into European sectoral policies demonstrates that synergies can be achieved between greenhouse gas emissions reductions (mitigation) and increasing climate resilience (adaptation) in some areas of EU policy, such as land-use management in agriculture and more efficient use of water resources. But for most EU policies, mitigation and adaptation are likely to remain separate endeavours. There are relatively few clear contact points for mitigation and adaptation, while the capacity to achieve fully integrated appraisals and actions remains limited. Cross-compliance has become an increasingly important dimension of EU policy, especially in agriculture, but the differing political goals manifest across policy fields, in combination with technical complexity, means that achieving 'win–wins' remains difficult. Climate mainstreaming is an argument for strengthening policy integration, but in practice takes place within the framings and procedures of existing policy fields.

If mainstreaming of mitigation and adaptation remains largely separate, we also find that there is an imbalance in the policy effort across these two broad objectives. Climate change objectives have been a central feature of EU energy policy for over a decade, complementing market liberalisation and energy security. Successive generations of EU emissions reduction policies have been put forward, including both declared objectives (normative mainstreaming) and concrete measures aimed at achieving these targets. The latest 2030 framework for climate and energy policy (EC 2014) envisages a 40 % reduction in domestic greenhouse gas emissions by 2030, compared with 1990, and sets new targets for renewable energy and energy savings. These are high-level commitments, demanding considerable political coordination within the European Union and of great importance for the standing of Europe internationally. They represent serious and binding commitments by member states, to each other and in the international arena. For some European states, like Germany, they represent a deeper vision about technological and economic leadership and the key to strategic European concerns about energy security.

This is much less the case for climate mainstreaming with respect to the goal of reducing vulnerability to climate change impacts and stimulating adaptation. Here, the politics are primarily domestic to EU member states, while the question of the proper role of European policy remains contested. There is no high-level narrative at the European level about adaptation to climate change, nor is there a strong argument for coordination. EU member states have pursued divergent climate adaptation policies at the national level as well (Biesbroek et al. 2010). Perhaps the strongest opportunity for coordination is through the expenditures of regional policy, which have a large impact in the least developed areas of the EU and may potentially contribute to support more climate-resilient infrastructure and economic development. At a time when growth and jobs are at the centre of European political concerns and when the role of European institutions is being widely questioned, climate mainstreaming will remain an issue that is dealt with in the 'undergrowth' of policy action. And this political reality has been strengthened by the broad perception that adaptation is a context-specific problem, best dealt with at the local scale.

As a result, the adaptation policy response has been mainly technocratic, through incremental adjustments to existing policies and measures, primarily achieved through changed routines of policy guidance and appraisal. The 2013 EU Strategy on Adaptation to Climate Change (EC 2013) emphasises the role of member state action, guidance and information, mainstreaming climate into sectoral policies and technical assistance in the EU's international assistance. The most substantial commitment relates to mainstreaming, in the shape of an objective that up to 20 % of the EU's Euro 960 Billion budget for the period 2014 and 2020 (the Multiannual Financial Framework, MFF) will be on '…climate-related expenditure'. This relates especially to the five European Structural and Investment Funds (ESI Funds), which account for about one-third of MFF expenditures and to investments made by the European Investment Bank and the European Bank of Reconstruction and Development (EBRD).

A key governance dilemma for climate adaptation mainstreaming exists between the need for central direction and the benefits of local discretion. The European Commission can play an important role in providing guidance, information and supporting capacities on the ground. But, given the spatial and social variability of climate vulnerabilities, as well as uncertainties about where and how quickly climate risks will emerge, local-level discretion in adaptation will continue to be important. Especially for long-term investments, there will be growing benefits in opting for robust solutions that are resilient under different scenarios.

An analysis of structural fund allocations in previous periods (Hanger et al., this issue) found that there are major opportunities to align investment in long-term infrastructures and to build adaptive capacity to achieve greater climate resilience in many regions, especially in southern and central Europe. But there is a clear danger that this remains a 're-labelling' exercise. Schemes that would have been funded under previous policy regimes may go forward, even if marginally adjusted. On the positive side, climate protection and climate resilience may be used as new ways of justifying investments. On the negative side, new guidance and appraisal methodologies will be seen as another hurdle to be overcome by administrators of policy at national and local levels. They will take the full measure of discretion they have been given—and which analysts have suggested is necessary—to make their own judgements. It is unclear that climate resilience will always be the winner. Looking to the past, we see this in the national, regional and local implementation of EU policies in biodiversity, water and structural and cohesion funding.

Where then might mainstreaming of climate adaptation succeed? The literature suggests that mainstreaming climate adaptation into EU policy is more likely where there is a shared concern about climate risks, high-level political commitment about the need to respond to these risks, 'hard' instruments (like mandates) and 'win–win' opportunities for linking climate and other policy goals. While many of these conditions exist in the interstices of EU policy, decision-making and implementation, the seriousness with which mainstreaming is pursued remains highly variable. Certainly, the current incremental and technocratic approach to adaptation in the EU makes the achievement of radical steps towards greater climate resilience less likely. Perhaps, the radical steps which have been achieved in mitigating carbon emissions in the EU will mean that the incremental and devolved strategy for adaptation is enough. But there is also a good chance that despite the best European efforts at growing a low-carbon economy, there will be a need for more radical measures to achieve climate resilience across key domains of European competence, like agriculture, biodiversity and infrastructures. Such an agenda of transformative climate adaptation might require the reconsideration of central assumptions in many EU policy domains. This prospect has not yet been addressed by European policymakers.

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