SEVERE WILDFIRES IN SOUTHERN EUROPE: Prevention and management through an integrated landscape-planning approach

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BirdLife INTERNATIONAL
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SUMMARY

Wildfires are increasingly a concern in Europe, particularly in the South: suppression through firefighting alone is not enough to tackle the problem. The affected European countries should adopt a holistic approach that integrates firefighting with the prevention of catastrophic wildfires through intelligent landscape planning and management that lowers fire risk whilst achieving win-wins for biodiversity and ecosystem services. Additionally, a landscape-based approach is needed to adapt to the local and regional specificities when addressing the ever-rising fire issue, adopting ecosystem-tailored fire-regimes.

1. THE BURNING ISSUE

The 2024 wildfire season saw exceptionally high temperatures that facilitated severe wildfires[1] that burned until the end of September, most notably in Portugal and in the Balkans. 2023 was also one of the worst on record with almost 500.000 hectares burnt in Europe, and the continent's single largest wildfire ever recorded (94.000 ha) in Greece. The escalation in the magnitude and virulence of wildfires in the last decade has seen the arrival of a new mega-fire paradigm[2], and more intense fires than previously possible (even generating their own fire-promoting weather systems[R2]): 0.3% and 1.2% of wildfires cause, respectively, 40% and 65% of the burnt area[R3,3].

The frequency and severity of wildfires are expected to increase further in the EU and the rest of Europe due to a combination of factors such as: changes in the climate (e.g. warmer temperatures and prolonged droughts); abandonment of traditional rural activities (e.g. low fire-risk mosaics of extensive pasture, crops and forestry); spread of densely planted and flammable plantations (and sometimes their abandonment) and of flammable exotic and invasive tree species; prevalence of forestry systems with too few tree species or structural diversity to slow the spread of fires; insufficient forest management planning and management activity.

The "new" wildfires are having significant ecological, economic, and social impacts[R5]. In 2023, 20 megatonnes of CO_2 emissions – equivalent to a third of all emissions from international aviation – were emitted by wildfires in the EU[R9]. This creates a substantial carbon debt – it takes years for trees to grow back to a size where they are absorbing large amounts of carbon from the atmosphere. Other impacts of wildfires include: loss of human life[4]; health impacts of smoke inhalation[5]; loss of timber and other forest-related incomes; damage to property, infrastructure and farmland; soil erosion (negatively affecting rivers) and increased flood risk; loss of biodiversity; and so on. For Southern Europe, an average wildfire season is estimated to lead to a yearly productivity loss of €13–21 billion [R9,R10].

The increase in frequency and intensity of forest fires is making it impossible for firefighters to cope with fire fronts of hundreds of meters or with emergencies that develop simultaneously in different locations. Wildfires affecting the periphery of urban locations (or "wildland-urban interface" – WUI) are the most dangerous, with serious social and economic consequences[R11]. In recent years, the number of civil protection interventions and the number of people affected and evacuated by forest fires have exponentially increased[R12,R13,R14].

[1] This document considers all types of wildfires, not just forest-fire, as all need to be considered in a landscape-planning approach
[2] E.g. the Portugal fires of 2017 burnt about twice the average total European burnt area[R1]
[3] When fires become very frequent, regrowth may not occur before the next fire occurs, leading to a risk of desertification[R4]
[4] A single fire in Greece, in 2018, killed 102 people[R6]. In 2017, 117 people were killed by forest fire in Portugal[R4].
[5] Wildfire smoke can cause or exacerbate a wide range of health problems [R7,R8]

2. THE WAY FORWARD

We are not powerless in the face of climate change, doomed to see the burning of our landscapes, settlements, and even people. There are major levers we can and should pull as part of an integrated approach (see text-box).

An *integrated, landscape-planning approach* for Southern Europe is the way forward to reduce the intensity of forest fires and make firefighting possible whilst supporting European objectives on biodiversity conservation and carbon sequestration. This paper outlines the fundamentals of this win-win approach[6], and provides recommendations for European national governments and for the European Union. Whilst the emphasis is on the EU and its policy framework, the recommendations are applicable in a general European geographic context.

THREE UNDEREXPLOITED LEVERAGE POINTS FOR TACKLING WILDFIRE RISK

1. **Human-caused ignitions.** More than 95% of wildfires in Europe are directly or indirectly caused by human activities[R15], with the WUI being the area where the risk of fire ignition is highest. Human causes need to be better addressed: from accidental ignitions (barbecues, cigarettes, sparks from agricultural machinery) to tackling arson.

2. **How we plan & manage our forests and wider landscape** has a direct impact on their susceptibility to fire.

3. **Ecosystem-based solutions** can provide win-wins for both fire risk reduction and broader ecological services and biodiversity.

2.1 Key principles of an integrated, landscape-planning approach in Southern Europe

From problem to solution. The approaches emphasised to date are not sufficient to control the escalating risks of severe fire – we need to do more. However, it is also important that our response does not make the situation worse or have adverse impacts on (C) stocks, biodiversity, or other ecosystem services provided by forests. Instead, we must pursue win-wins through an integrated landscapes approach. The opportunity is to ensure our landscapes meet various objectives whilst preventing severe fires: conserving biodiversity, adapting to climate change and contributing to rural development.

Beyond suppression vs prevention[7]. It is, of course, imperative to invest well in firefighting - for the protection of human life, property, infrastructure, as well as natural ecosystems that are vulnerable to fire[8]. Yet, it is clear we cannot control this problem solely by improving the efficacy of firefighting ("suppression"). In areas where fire

[6] For further reading on integrated fire management, see R4.

[7] "Fire suppression" is a commonly used term, essentially meaning "firefighting". "Fire prevention" is also a commonly used term, though in this paper, we use "fire disaster risk reduction" more often, as "prevention" may give the impression of always prohibiting naturally occurring fires and prescribed burning practices, whereas more nuance may be needed.

[8] One study concludes that 50% (globally) of ecoregions have very high or high ecological vulnerability to fire, while 21% have low vulnerability, and that "global ecological value may be reduced by as much as 50%" due to the escalating impact of fire on poorly adapted ecosystems[R17].

is a regular natural occurrence (e.g. in much of the Mediterranean[9]), aiming to totally avoid any and every fire event (another way the word "suppression" is used) can magnify the problem in the long-term by accumulating fuel build-up and accelerating the transition to more flammable and fire-prone landscapes[10], so that fires are more severe when they eventually occur.
A holistic approach, therefore, combines "suppression" and "prevention" (landscape planning and forest restoration) for a sophisticated fire-risk management. Post-fire restoration is a crucial task, too, if the forest does not naturally recover after wildfires.

Multi-sectoral, multidisciplinary, participatory. An *integrated landscape-planning approach* requires joined-up thinking between forestry, agriculture, and wider landscape and socio-economic planning. A participatory and collaborative process of landscape design and management planning is needed. Public-private sector collaboration is important, with agreements between administrations, livestock farmers, forest owners, even the tourism sector in some areas and the local population to allow the objectives of specific properties to be aligned with landscape-scale objectives.

Landscape planning is needed to ensure a birds-eye view is taken that maximises protection of key assets from fires whilst meeting numerous land management goals and reconciling potential trade-offs[11]. Spatial planning needs to include the spatial zonation of: human infrastructure and ecological areas in need of priority protection from fire (e.g. fire-fighting and high nature value buffer zones); where fires are natural and can be allowed to unfold under defined circumstances (or where prescribed burning can be used); low-flammability win-win land- uses (below); flammable areas in need of regular management or further risk reduction measures; and so forth depending on context.

Strategic - short & long term. An *integrated landscape-planning approach* considers both short-term and long-term planning horizons. It is strategic in the sense of moving in a concerted direction of positive outcomes (environmentally, socially, and economically), whilst also addressing immediate urgent priorities.

Location-specific. An *integrated landscape-planning approach* requires joined-up thinking between forestry, agriculture, and wider landscape and socio-economic planning. A participatory and collaborative process of landscape design and management planning is needed. Public-private sector collaboration is important, with agreements between administrations, livestock farmers, forest owners, even the tourism sector in some areas and the local population to allow the objectives of specific properties to be aligned with landscape-scale objectives.

Informed by science & utilising technology. It's important to take advantage of scientific research – e.g. to ascertain causes of local wildfires and to analyse statistical data to identify the priority action areas where wildfire risk is highest. It has been observed that by intervening in 10-15% of the landscape, the resilience of the territory as a whole can be increased[R22]. Effective new technologies should be deployed, such as systems of early detection (especially in nature protected areas and the WUI). In a twelve-month monitoring period during which specific video cameras at the border of three protected areas were installed to test how technology could support wildfire prevention, more than 10 wildfires were effectively detected at an early stage[R23].

[9] The natural "fire return interval" varies markedly between different forest types within these biomes[R18], further underlining the need for regional landscape planning with risk-reduction measures tailored to specific localities.
[10] This is called the "fire paradox" – when efforts to suppress fire lead to conditions that ultimately aid fire[R19]. See also R20.
[11] See R21 as a Portuguese example of how pressures from climate change and fire risk necessitate a spatial planning approach to enable the ongoing meeting of management goals for ecologically protected areas, agriculture, and fire safety.

3. WIN-WIN LANDSCAPE SOLUTIONS

In Europe, rising climate risks such as fire, drought and flood, "are occurring on a landscape that has already been dramatically altered by people – including in ways that exacerbate these challenges"[R24]. We must harness the power of natural forests, wetlands and floodplains to store water, sequester carbon, protect ecosystems, and ultimately cool us down. Illustrations of win-win approaches that can reduce fire risk whilst boosting ecosystem services are given below. The most advantageous measures to deploy will vary from location to location.

- **Protection & restoration of hydrologically important ecosystems such as wetlands, peatlands, riparian habitats, coastal and mountain forests.** The European continent has lost 80% of its wetlands[R25]. Wetland ecosystems are important for maintaining the hydrology of the landscape and for providing refuge areas to biodiversity when fires do occur[R26], as well as being invaluable for biodiversity and ecosystem services. "Rivers, lakes and wetlands" can be "natural fire barriers…that reduce the importance of forest fires in landscapes"[R18]. Re-wetting of peatlands is important as peat develops in waterlogged conditions, and whilst drained peatlands degrade into fire hazards, intact peatlands are very fire resistant[R27,R28,R29]. Forests are also essential for intercepting rain and infiltrating it into soil, thereby replenishing aquifers, regulating river flow and reducing flooding. Furthermore, forests, especially at altitude and near the coast, are important for maintaining rainfall (and helping avoid and fight forest fires) across Europe[R30].

- **Restoration & increased protection of natural forests.** Many highly fire-resistant, biodiverse European forests have been converted into drier landscapes or fragmented into a small proportion of their natural range[12]. Their restoration can reduce landscape-level fire risk whilst benefiting carbon stocks, biodiversity, hydrological regulation, etc. Natural forests, as well as being far higher in biodiversity[R33], often have a lower fire-risk than plantations as their structure provides many "speed bumps" to make it harder for fire to progress – such as uneven vertical and horizontal structures which break up the continuity of fuel supply, a diversity of tree species that is often far less-flammable than plantations, and the maintenance of higher humidity levels[13].

- **A greater proportion of closer-to-nature forest management (CFM)** in the productive forestry estate would help to reduce fire hazard for the same reasons as described above regarding natural forests. CFM systems that deploy a diversity of tree species, in an irregular spatial structure, can provide a forestry estate far less prone to fire than the densely-planted monocultures of an even-age that provide a continuous and flammable canopy (which increases the risk of catastrophic "crown fires" burning through the tree tops)[R39,R40,R16]. Large, older trees can be more resistant to fire[R41,R4] and help keep forests more humid and fire-resistant, so permanent habitat trees should be a key feature of CFM systems.

- **Fire-regulating ecosystem services of fauna**. Herbivores are nature's way of eating fire-fuel and trampling fire-breaks[R42]. Large herbivores in European forests have historically included bison, horses,

[12] For example, Portuguese oak forests are now rare, and often replaced by flammable eucalyptus or pine monocultures[R31]. Temperate "rainforests" have also shrunk drastically (e.g. Ireland, UK, etc.) e.g.[R32].

[13] Native broadleaf tree species (particularly deciduous) are often amongst the least flammable whilst being important for biodiversity[R34,R35]. In contrast, pine and eucalyptus (extensive in fire-prone monocultures in Portugal and Spain) are very flammable, especially when planted at high density. In Portugal, maritime pine plantations are so flammable as to be considered incompatible with economic forestry[R36]. Eucalyptus emits volatile compounds "which generate a flammable atmosphere"[R37], as well as flammable leaves, fine debris, peeling bark that form "ladder fuel" that increase the risk of fire spreading to the crown, and "spotting" is a high risk - ignited leaves and bark debris can be taken kilometers on the wind and cause new fires[R1,R38,R37].

deer, and wild boar, the general decline of which led to a more flammable landscape[R43]. Rewilding efforts to reintegrate wild herbivores should be encouraged in appropriately defined areas. Livestock integration can be considered when wild herbivores are absent, either as part of HNV farming systems (below), or to emulate absent wild species[R44,R45]. In all these situations, the number of herbivores needs to be regulated to ensure herbivory does not become excessive and prevent forest regeneration, and natural predators can play a role. In this way, wolves are forest protectors (e.g. preventing over-browsing of young trees by deer)[R46] and contributors to an holistic, landscapes approach to fire-risk reduction. The re-establishment of beavers is also important – they are native to most of Europe but often locally extinct. Beavers are "ecosystem engineers" that create complex wetlands and help spread groundwater and hydrated vegetation, and provide refuge for other species during fire[R47].

- **Biodiverse grasslands** should be protected and restored (with intact fuel management from herbivores, or cutting)[R48], and grassland firebreaks can be deployed and managed for biodiversity[R49].

- **High-nature value (HNV) farming systems** such as extensive agrosilvopastural practices (e.g. dehesa/montado in grasslands formations) and agroforestry (orchards, olive and almond groves, etc.) can contribute to a lower-risk land mosaic. Such traditional farming practices can be rich in "farmland" biodiversity[14], contribute to landscape connectivity (through hedges, scattered trees, etc.), whilst reducing fire-risk through the fuel-load reduction actions of management activities (e.g. hay-making) and the actions of livestock as they graze, browse, and trample. HNV farming should not be at the expense of restoring forests (which may be under-represented even in areas rich in HNV farming) and of course should not be created by converting natural forests. In fire-prone landscapes such as the Mediterranean, such HNV farming systems can be a component of land-use planning that helps reduce fire-risk whilst providing biodiversity benefits[R21].

- **Fighting fire with fire.** In places where forests naturally burn from time to time such as the Mediterranean, it can be considered to allow a more natural frequency of cooler burns to occur (having pre-planned where and under which conditions). A possibility is also to carefully mimic natural fire regimes with prescribed burning in order to reduce fuel build-up and safeguard species that need fire[R52,R4,R44,R53,R54].

- **Biodiversity sensitive additional fire prevention measures** can also be deployed where further measures are deemed necessary. For instance, in areas of high fire-risk in the Mediterranean, it is common to reduce fuel load by "cleaning" the forest of deadwood and shrubby vegetation. This, however, has adverse biodiversity and climate impacts: deadwood is essential for biodiversity[15], carbon stocks and soil moisture and nutrients, and should not be interfered with or removed as a general rule. Fire-risk should not be used as an excuse for commercial extraction of deadwood as it happens in some cases. Fine-woody debris are far more flammable[R57] and they often reduce in mature forests due to shade; the silvicultural approach is a more significant influence on level of fire-risk (see above)[16]. In targeted areas of highest-risk such as wildland-urban interfaces (WUI) in the Mediterranean region, biodiversity-sensitive approaches should be preferred to manage the flammable vegetation that adjoins houses and infrastructures. In Portugal and Spain, it is common for montado/dehesa farmers to plough away flammable shrubs in order to discourage fire that could spread through the grassland layer, which only creates the disturbed soil in which those same flammable shrubs (such as C. *ladanifer*) regenerate, thus perpetuating the cycle. Instead of ploughing, which causes huge soil erosion, more sensitive approaches

[14] For more info, see [R50] and [R51].

[15] E.g. Half of the 12,000 catalogued species in Poland's Bialowieza Forest are dependent on decaying logs[R55]. There are many examples of thresholds of deadwood loss below which species become locally extinct[R56,R34].

[16] In some forests, deadwood accumulates moisture over time so can help maintain humid conditions[R58]. Deadwood levels are generally far higher after fire (when risk of fire is lowest), than before fire, and post-fire deadwood removal (salvage logging) can impede ecosystem recovery[R59].

can be deployed such as facilitating the return of mature oak woodland (from which cork can also be harvested), or chop-and-dropping the material without disturbing the soil and leaving a mosaic of intact shrubs for wildlife (such as nesting birds, lynx, etc.)[17] (see text-box 2).

- **Natural regeneration processes** should be prioritised over planting after wildfire (unless there is a lack of natural species nearby to re-establish), because natural regeneration is often more effective, cost-effective, as well as more biodiverse[18]. Tillage and deadwood removal should be avoided wherever possible to avoid soil erosion (which can lead to desertification in southern Europe), adverse impacts on biodiversity and slower natural regeneration[R62.] .

[17] This can be done in a variety of ways, including tractors which instead of pulling a plough, feature equipment that break-up shrubby material[R60,R61]. This should be done outside of bird-nesting time.

[18] If absolutely necessary, consideration can be given to utilization of more resilient flora, using scientific criteria (e.g. preferring as- near-as-possible genotypes).

4. RECOMMENDATIONS FOR EUROPEAN COUNTRIES

4.1 Mainstreaming across spatial planning, legislation, governance & enforcement

Spatial planning, applying the principles herein, should be developed by central and local governments and their stakeholders. Cooperation between administrative units and communities, including transnationally, should be pursued where borders are crossed by forests and the wider landscapes on which fire-risk depends19. An integrated, landscape-planning approach should be mainstreamed across implementation of EU legislation: from the Nature Directives (e.g. which habitats are most vulnerable to fire and in need of priority protection, and which habitats actually need an appropriate fire regime) and the Nature Restoration Law (e.g. in the development of National Restoration Plans which must integrate considerations of disaster prevention, land degradation, etc.20) to other spatial instruments such as the Water Framework Directive, National Climate Change Adaptation Plans, etc.

National forest strategies, land management rules and payment for ecosystem services schemes should be reviewed to reduce high-fire risk practices and encourage win-win landscape measures.

National governance systems need to ensure the roles and interactions of different sectors and bodies come together to deliver a joined-up approach. The principles herein also need to be mainstreamed within organisations: e.g. a local municipality might review its risks and decide to remove public barbecues from high-risk areas, discourage planting lines of Eucalyptus where they can bring fire to properties and infrastructure, manage cigarette-vulnerable road verges as biodiverse grasslands, etc. Since humans cause most wildfires in Europe, national measures need to be deployed to minimise human ignitions: for instance, through prohibiting or discouraging practices that cause negligent wildfires, and effective deterrence and enforcement (e.g. serious fines for arson, and a review of the local reasons for it).

4.2 Invest now to avoid costs later

National investment. Funds should be secured to meet local priorities, from enabling public administrations to increase their technical capacity and expertise, to acquiring and operating technologies that rapidly detect wildfires. Equally, national subsidies should be taken away from high fire-risk and low biodiversity practices.

Utilise European support. The Civil Protection Mechanism (CPM) is well known as the EU's emergency response facility – a significant portion of which is used to help Member States respond to wildfire (30% between 2007 and 2019). The CPM can also be used in prevention: in Portugal, the funds allocated to suppression and prevention, respectively, shifted in emphasis from 80%-20% in 2017 to 39%-61% in 2022[R63]. Other EU funding, from the Common Agricultural Policy to Regional Development and Cohesion Funds, can be used by Member States to support various aspects of a holistic approach, from training and awareness-raising to post-fire ecosystem restoration[21].

[19] The appropriate collaborating administrations will depend on context, such as National Park Authorities, Biosphere Reserves, and local or regional governments, and will likely dovetail with national initiatives such as civil protection. Community groups, forestry companies, etc., may also be important contributors to cross-border collaborations.

[20] Article 14(9) of the Nature Restoration Law requires Member States to identify synergies with climate change mitigation, climate change adaptation, land degradation neutrality and disaster prevention, and to prioritise restoration measures accordingly.

[21] DG Env summarises existing EU funding mechanisms in its guidelines on wildfire prevention[R4]

4.3 Promote community-based fire prevention

People are essential for wildfire prevention: from making the planning and management decisions which determine how flammable land becomes, to serving as local brigades to control small fires before they escalate. Countries need to focus on creating fire-smart communities that can implement best practices that do not cause negligent wildfires, and generally make their territory more resilient[R64]. The involvement of local public administration and communities in fire prevention efforts allows to obtain the so-called inclusive conservation.

THREE EXAMPLES OF EMPOWERING FIRE-SMART COMMUNITIES

Awareness-raising and capacity-building can help to build a solid culture of wildlife risk reduction, through activities such as information campaigns, engaging schools, addressing problematic uses of fire that causes accidental ignitions (e.g. reusing farm residues as biomass instead of burning them), helping communities deliver win-win landscape measures, training volunteer firefighter groups and tourist associations to allow people to better protect their properties in the WUI. WWF Italy is coordinating the project "OFF - Out Forest Fires"[R65] that aims to empower local communities in forest fire prevention, for example by encouraging good practices to be used as an alternative to fire in agro-forestry, the reuse of wood material and the management of abandoned land.

Collective forest management can be encouraged to help communities become proactive and collaborative in reducing fire risk whilst increasing their stake in their forests. This, for instance, is an approach in Portugal to address the highly flammable monoculture plantations of fire-exacerbating species (e.g. Eucalyptus) through establishing limits to new plantations, promoting more diverse silviculture, and reversing abandonment[R57,R62]. In Germany, community approaches have helped diversify pine monocultures with deciduous tree species whilst also diversifying production and promoting forest multi-functionality.

LIFE Lx Aquila project[R66], Portugal. This project, coordinated by SPEA (BirdLife's partner in Portugal), supports the locally rare Bonelli's eagle whilst simultaneously pursuing wider benefits to nature and land managers. The project fosters a network of custodians across multiple locations, who collaborate not only on eagle conservation measures (such as population monitoring and patrolling to prevent illegal hunting and poisoning), but also on land management to reduce the risk of severe fire, which can adversely affect hunting grounds and nesting sites. In the Municipality of Alenquer, fire-prone exotic species such as Aleppo pine are being removed and replaced through natural regeneration of native species such as cork oak and holm oak. In the Tapada Nacional de Mafra, flammable shrubs are being managed without ploughing the soil, using hand-held strimmers as well as tractor-mounted chain brush-cutters.

4.4 Biodiversity protection while preventing wildfires

An important goal of wildfire prevention is the conservation of biodiversity. Measures deployed in the field should be consistent with this goal. Utmost attention is needed in preventive forest management and during post-fire restoration activities, to avoid impeding ecosystems from developing to maturity and providing optimal niches for biodiversity. Ecologically impactful measures such as the aerial spraying of anti-inflammable should be avoided unless in extremis. Great care should be taken in the planning and implementation of prescribed burning. If high-risk situations genuinely call for suppression measures that could have adverse ecological impacts, biodiversity-sensitive measures should be preferred and innovated (see above).

5. RECOMMENDATIONS FOR THE EUROPEAN UNION

It is imperative that the EU strengthen its actions on wildfires whilst adopting the *integrated landscape-planning approach*. Like forests themselves, forest fires are often transboundary, as are the smoke pollution and greenhouse gases they emit and their impacts on human infrastructure, communities, rivers, and so on.

5.1 Climate change mitigation

Severe forest fires emit significant carbon[R46]. Furthermore, achieving EU targets (under the European Climate Change Law) depends on maintaining or increasing the land and land-use (LULUCF) carbon sink. However, the EU's carbon sink has declined dramatically over the last decade, fire being amongst the contributing factors[R67]. Annual emissions from forest fires outside the tropics are increasing whilst the northern hemisphere carbon sink is decreasing: we must be proactive in addressing the "increasing vulnerability of forests and their carbon stocks to fire disturbance"[R68,R69,R70]. Increasing the area of natural forests, strictly protecting all remaining primary and old-growth forests, and increasing the share of CFM within the productive forest estate (as per Biodiversity and Forests strategies[R71,R72]), can increase our carbon sink and support biodiversity within a lower fire-risk landscape (see Section 3).

5.2 Climate adaptation and resilience

Whilst cutting carbon emissions is a priority, it is also urgent that the EU coordinates efforts to prepare for the climate change that is already in motion. The European Climate Risk Assessment (EUCRA) concludes that "Europe is not prepared for rapidly escalating climate impacts", and identifies wildfires in the highest category of priorities, posing risks to population, built environment, carbon sinks, biodiversity, agriculture, tourism, etc.[22.]. The EUCRA also underlines that such risks depend on both the extent of climate change and non-climatic risk drivers such as land-use management.

In addition to direct damage from severe wildfire, indirect impacts are also important. The effects of climate change are frequently felt through excesses or shortages of water[R74]. Severe fire reduces tree and vegetation cover and thus exposes soils, resulting in less rain infiltration, less aquifer recharge, more erosion that pollutes waterbodies, more flooding, and damage to the rain-generating and temperature-moderating functions of forests. The application of an *integrated landscape-planning approach* to fire is crucial in the context of climate adaptation[23].

There is a strong need for the EU to more vigorously guide, coordinate and drive Member States' climate adaptation action[R74]**.** The commitment made in the European Water Resilience Strategy to "give priority to using the full potential of our ecosystems to store, purify, release, and restore water on land and at sea" should be fully implemented, using all existing legal instruments. The **European Climate Adaptation Plan** is expected in 2026[24] should promote an *integrated landscape-planning approach* to fire[25]. For example:

- The EC should support the implementation of this approach in National Climate Change Adaptation Plans[R77,] assisting Member States in a spatial planning approach that emphasises the win-win

[22] See R73

[23] An integrated, landscape-planning approach to fire is a good example of applying principles that WWF have outlined for adapting to climate change impacts: work at the system scale, based on science; use nature to help people; avoid harming nature; help nature adapt; support the most vulnerable groups first[R75]

[24] Announced by Ursula von Der Leyen in her Political Guidelines speech, July 18 2024 and listed as a flagship action under "- Security and preparedness to boost collective resilience" for 2026 in the European Water Resilience Strategy, 4 June 2025.[R76]

[25] WWF and Living Rivers Europe have previously urged the EC to draw up a new Climate and Water Resilience Law.[R74]

landscape measures set out herein, and ensures synergy between relevant EU policies and legislation (see "mainstreaming", below).

- Low-biodiversity, high-fire risk land-uses should be identified and mapped (such as eucalyptus and densely planted conifer plantations) and support given to their being converted to higher-biodiversity, lower-fire risk land-uses such as CFM forestry, HNV farming, or nature restoration areas.
- Ecosystems of hydrological importance for resilience to climate change should be identified and mapped, from groundwater, rivers and lakes to wetlands and rain-generating forests, and their protection should be encouraged (in synergy with the Water Framework Directive). Where they have been destroyed or degraded, restoration efforts should be supported (in synergy with the NRL) such that all of Europe enjoys strong hydrological regulation from natural ecosystems.
- Financial support mechanisms should be reviewed that can help implement the approach set out herein, including the redirecting of subsidies away from supporting low-biodiversity, high-fire-risk land-uses, towards implementing the integrated landscape-planning approach (see "Funding", below). Training and capacity building can help multiply the uptake of measures such as CFM forestry, ecosystem restoration, rewilding projects, HNV farming, community firefighting, prescribed burning, etc. An EU-wide package of capacity building should be developed to equip key stakeholders with the skills they need to deliver the integrated landscape-planning approach across the EU.

5.3 Mainstreaming in EU policy & legislation

Catastrophic forest fires impede efforts to meet the goals of numerous EU policies and legislation. An *integrated landscape-planning approach* should be mainstreamed across all relevant policy and legislation. In addition to climate change instruments (above), further examples are given below.

The Civil Protection Mechanism and the **EC Wildfire Prevention Action Plan** are examples of EU proactivity and unity in the face of the increasing challenge posed by wildfire. However, more focus is needed on ecological win-wins.

The EC should maintain and strengthen efforts to implement several aspects of the **Biodiversity and Forests strategies**[R71,R72] that can help achieve an *integrated landscape-planning approach*, such as protecting, restoring and enlarging EU's [natural] forests to combat climate change; protecting all remaining primary and old-growth forests; reversing biodiversity loss and ensuring resilient and multifunctional forest ecosystems and encouraging the uptake of CFM within the productive forestry estate.

The EC's efforts to coordinate strong implementation of the **Nature Restoration Law** and **Birds and Habitats Directives** need to integrate the principles described herein, as these are key legislations that can help to support the creation of a low-fire risk, high-biodiversity landscape[26]. Those Natura 2000 sites (and Annex 1 habitats outside the Natura 2000 network) that are particularly vulnerable to fire, need to be effectively protected – both through the spatial planning approach advocated herein, as well as the utilisation of early detection systems, and ensuring sites of community interest are well covered by fire-fighting plans.

A strong **Forest Monitoring Law (FML)** needs to be agreed. The EC's proposal includes several valuable indicators, such as the occurrence of Fire events, and aspects of Wildfire Risk Assessment. Additional indicators should be added, such as cause of fires, the natural Fire return intervals of forest types, species that require fire, and the usage of prescribed burning. In order to be useful, this data must be geographically mapped - e.g. to be able to analyse which types of forest are being most affected. The FML proposal also encourages (but does not mandate) Member States to produce integrated long term (forest) plans that explain

[26] Article 14(9) of the NRL requires synergies with climate change mitigation, adaptation, land degradation neutrality and disaster prevention, to be identified, and for restoration measures to be prioritised accordingly.

how the MS intends to integrate goals of biodiversity, bio-economy, climate mitigation and adaptation, including a specific section on disaster risk assessment and management which is an opportunity to implement an integrated, landscape- planning approach[27].

Renewable Energy Directive, RePower EU, Circular Economy. The outputs of forestry are threatened when the forestry estate burns out of control. Legislation and strategies regarding the bio-economy should encourage forest management that provides clear co-benefits for fire-risk management, carbon storage and biodiversity. RED sustainability criteria are deeply flawed, pending further changes to the Directive. Member States must apply stricter conditions at the national level to ensure that bioenergy delivers genuine climate benefits[28]. As a bare minimum, the current criteria in the Directive should be fully implemented, and in particular, primary and old-growth forests must not be utilised for sourcing bioenergy.

LULUCF Regulation and Carbon Removals Certification Framework. As already explained above the land sink is drastically declining for the past 10 years. This trend must be reversed. Carbon dioxide removals are needed to meet the EU climate objectives. The EU should be favouring direct, quick and cheap natural removals over expensive and unproven technological solutions such as Carbon Capture and Storage, recognising risks of reversibility and measurement challenges[29].

Water Framework Directive. Forested catchments and riparian forests are crucial to achieving WFD goals on water quality, water provision, mitigating floods and droughts[30]. The latest report on the implementation of the WFD stresses that all Member States should put in place additional measures for "boosting efforts on nature-based solutions, including renaturalisation and ecosystem restoration to reduce hydro-morphological pressures"[31].

Security and stability. "Heat impacts, flood risks and forest fires are a direct risk to the European continent" – damaging infrastructure, agriculture, regional development, and placing increased strain on defence services (e.g. as first responders to emergencies)[R67,R84]. Increased severe fire is also a global trend affecting EU security[32].

Agriculture and regional development. Farms and productive forests are impacted by wildfire. At the same time, farmers and foresters are important actors in making and implementing landscape management decisions that determine fire-risk. Uptake of Common Agricultural Policy (CAP) funds for environmental forest measures has been low[R87]. Being the EU's largest funding stream, the CAP should be a far more effective vehicle for rewarding farmers and foresters for delivering higher-biodiversity, lower fire-risk landscapes through increased set-aside of natural forests, uptake of CFM, and support for HNV farming.

5.4 Funding

The European Court of Auditors (ECA) recently published a report that assesses how the Commission and EU Member States used EU funding to address forest fire prevention, preparedness, and restoration in the EU. The audit found that money is not always spent effectively nor systematically where needs and risks are

[27] See WWF Asks on the Forest Monitoring Law (WWF 2024)[R78], and Benefits of the Forest Monitoring Law (NGOs 2024)[R79]

[28] WWF guidance of EU Member States on bioenergy plans and policies (2024)[R80]

[29] See WWF carbon dioxide removals briefing papers[R81]

[30] Forest fire has major impacts on flood risk but also on water quality (due to sediment from soil erosion as well as pollution from smoke deposition, e.g. particulates, heavy metals)[R82]

[31] European Commission, Report on the implementation of the WFD and Floods Directive, February 2025, COM/2025/2 final[R83]

[32] Just as the EC recognises fire as an urgent climate risk to EU property, agriculture, and so on[R5], the same risks contribute to instability beyond Europe with implications from displacement to geopolitical competition for resources[R85]. The EU's Security Compass considers climate change and disasters (e.g. fire, flood) as "threat multipliers"[R86]

highest. In addition, the report underlines that the Commission has an incomplete overview of the amount of EU support spent on forest-fire-related measures and of the results achieved, and that despite Member States increasing their use of EU funding for forest fire prevention, a long-term perspective of the results was not always taken into account although this is crucial for getting tangible results[R88]. We have the following recommendations:

Multiannual Financial Framework. More funds are needed for climate adaptation, including an *integrated landscape-planning approach* to fire. "The viability of EU solidarity funds is already critically threatened as these have been oversubscribed by various costly events, such as floods and wildfires in recent years"[R5]. As set out in more detail in a Joint Statement by WWF, BirdLife and other NGOs[33], the next multi-annual funding framework (MFF), 2028-2034, should:

- Scale up dedicated funding for nature restoration and conservation**.** This should encompass a range of activities that contribute directly to the implementation of the Nature Restoration Law and broader nature protection measures linked to the implementation of the Nature Directives and the EU 2030 Biodiversity Strategy, and help to mainstream an *integrated landscape-planning approach* to fire.
- Strengthen biodiversity mainstreaming through all EU funding programs. This also necessitates mainstreaming an integrated landscape approach to fire[34].
- Prevent EU funds from financing investments that damage biodiversity or the climate. This needs to include channelling forestry subsidies away from lose-lose scenarios of low biodiversity and high fire-risk (such as planting dense monocultures of flammable species), towards win-win management measures as per the *integrated landscape-planning approach* to fire. Subsidies for industrial wood burning for bioenergy must be stopped immediately. Burning wood for bioenergy reduces carbon stocks whilst emitting more carbon per KwH than fossil fuels (during crucial decades in which we must cut emissions)[R92,R93]. Bioenergy may be harvested (it is not just residues that are used), or areas may be clear-cut. Damage has been documented in remaining old-growth forests[R94]. Bioenergy and pulp and paper installations encourage a forestry paradigm of low biodiversity, higher fire-risk, densely planted fast-growing plantations of eucalyptus and conifers[R1,R38,R95] – a proposed new pulp and paper installation in Galicia being a current example[R96].
- A theme of the EC's Wildfire Prevention Action Plan is "increased financing for wildfire prevention actions"[R97]. The MFF should support this objective, aligning with the win-win approach set out herein.

[33] See R89 and R90

[34] See WWF position paper R91

6. CONCLUSION

Europe is at an inflexion point with regards to fire. If we turn a blind eye to current landscape management and governance - that at best is proving insufficient to meet the challenge, and at worst exaggerates the risk of severe fire (e.g. by draining wetlands or establishing flammable monoculture plantations), particularly but not only, in Southern Europe - we will see a negative spiral with significant damage to communities, forestry, farming and biodiversity. Or, we can be positive, prioritising a win-win, no-regrets approach that reduces the risk of severe fire whilst helping us to stabilise and restore biodiversity, carbon sinks and the ecosystem services on which we increasingly depend in this century of climate change.

An *integrated landscape-planning approach* to fire is urgently needed.

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N.B. In the main text, references are distinguished from footnotes with a preceding [R].

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SEVERE WILDFIRES IN SOUTHERN EUROPE: PREVENTION AND MANAGEMENT THROUGH AN INTEGRATED LANDSCAPE-PLANNING APPROACH.

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