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Forest ecosystem services

Note by the Secretariat

I. Introduction

1. Recent decades have shown increased awareness of forests being much more than trees or wood. Traditional silviculture has evolved from focusing primarily on timber production to multi-objective management, better integrating other uses of forests. Forest management is now broader-based, and takes into account the important role of forests as ecosystems that support life in all its varied forms.

2. There is growing recognition that forests can provide many benefits, identified as ecosystem services. Some of these, such as recreation, relaxation, or shelter are well appreciated by the general public while some others are less understood, or simply taken for granted. The Millennium Ecosystem Assessment of 2005 defined ecosystem services as provisioning (food, water, wood, genetic resources), regulating (climate, floods, disease, water quality), cultural (recreation, spiritual benefits) and supporting (soil formation, primary production) (UNEP, 2005). Forests provide vital habitats for a multitude of animal and plant species, regulate water flow, protect water quality and supply clean air.

3. This background paper sets the scene for three panel discussions that will focus on three topics related to ecosystem services. It gives some information about their present status and examines the challenges which foresters and society face in maintaining these services. Finally, at the end of each section, there are points that may be considered by the Committee and the Commission.

II. Panel 1: Disaster risk reduction and watershed management

1. Snapshot – Current Situation

4. The value of many forest ecosystem services is well demonstrated and known to the general public. Others are ‘invisible’, where the contribution of forests to human safety and well-being is not so well known, and may result in a forest being mismanaged or even removed, as it may not be seen as being of value. In the discussion below, the regulating services forests provide will be defined and exemplified, and the degree of public awareness assessed. This list is not exhaustive - forest ecosystem services are too diverse for all to be included here – but it covers the major regulating services.

(a) Soil Protection

5. The role of any plant life, but particularly of forests, in preventing soil erosion by water or wind is well-known. Forests stabilize soil through complex root structures that reduce soil erosion, as well as improving water and nutrient infiltration and cycling. Trees and forests are used extensively for erosion control in wetlands and threatened coastal areas. One of the most graphic examples of this in the UNECE region is the Tennessee Valley Authority forest project.

Example 1: Tennessee Valley Authority Hydro-Electric Dams

The extensive Tennessee river system has over 30 hydroelectric dams, all of which would need regular, expensive, sediment-clearing dredging operations (Encyclopedia 2003, TVA 2011). However, the need for this is minimised by the extensive upriver forests, which prevent excess soil erosion, thereby dramatically reducing sedimentation.

These forests were planted by the Tennessee Valley Authority (TVA), originally set up to cope with a previous environmental disaster in the 1930s. This was the ‘dust bowl’ era, which gave rise to Franklin D. Roosevelt’s famous speech which began, “A nation that destroys its soils, destroys itself. Forests are the lungs of our land, purifying the air and giving fresh strength to our people.”

The dust bowl effect returned in the 1970s due to unsustainable farming techniques, and the TVA initiated a tree-planting programme which resulted in a 60 per cent increase in afforestation level within the valley. This led to greatly improved soil retention, plus the aforementioned beneficial effect on the TVA hydroelectric dams (TVA 2011).

(b) Protection and Prevention from Avalanches and Landslides

6. The role of forests in preventing or minimising damage from these disasters is well-known in mountainous countries, though perhaps underestimated elsewhere. The forest acts as a natural break, absorbing some or all of the energy of the downhill progress of, for example, avalanches or rockfalls, and impedes run-off processes. Forests further help stabilize and protect from disasters like shallow landslides. They cannot guarantee protection from exceptionally intense and concentrated rainfall, nor from the kind of tectonic movements such as those experienced in Nepal 2015 where fully-forested hillsides collapsed. However, forests are part of a range of strategies for disaster risk reduction, and are among the simplest and most cost-effective ones, given that forests need little maintenance and will often recover after damage.

Example 2: Austrian “Protection through Forests Initiative”

The “Initiative Schutz durch Wald – ISDW” began in 2007 to improve forest protection of human habitats from, primarily, avalanches, at a cost of EUR 5.7 million per year. It continues a long tradition of similar Alpine forest strategies, both within Austria and elsewhere (FAO 2010).

Within this scheme, the already-recognized need for protective forests is streamlined, with a framework developed locally and approved by provinces, which is pursued in projects with the cooperation of local landowners and other stakeholders. The process is structured as transparent as possible, with a publicly-available project manual used as the scheme's terms of reference, backed up with a user-friendly database.

(c) Flood Control

7. Reducing the power of floods is only a part of the flood control service provided by forests. Forests act as a sponge, soaking up water and releasing it over time, furthermore the forest canopy intercepts heavy rainfall, allowing for evaporation and delay in reaching the ground, leading to flash-flood reduction. Furthermore, the canopy delivers all remaining water gradually to the earth, where the sponge, and energy-absorption effects reduce the danger of floods. Public awareness of 'water regime management' by forest services is often low, and there can be unwarranted fears that the forest may act as an embankment, narrowing the river and increasing flooding (as in the Laver example, below.

Example 3: Laver River Woodland Flood Project, Yorkshire

The Laver river in Yorkshire, Northern England, is prone to flooding, making it an ideal area for a demonstration floodplain woodland (Murphy, 2007). A group of British government agencies, including the Forestry Commission, investigated the impact of woodland on local flooding.

Among the results, the study conclusively demonstrated that the woodlands significantly reduced flood velocities, desynchronized flooding with local rivers, and delayed flood flows/peak. Modelling showed that a number of smaller plantings would be just as effective as one large woodland area.

The study recommended woodland plantings as a low-cost, low-maintenance approach to flood control, especially in areas/countries with limited investment potential. It also reviewed the objections local people brought against the scheme, including a concern that a less effective solution had been proposed on the grounds of cost, and an unsubstantiated fear that creating forest embankments would actually lead to increased flooding.

(d) Water Quality

8. There is a high degree of awareness of how forests filter water and maintain its quality (example below). However, the role of forests in maintaining precipitation is only beginning to be recognised. In the Amazon and Congo basins, deforestation has led to reduced precipitation, meaning that rainfall-gathering for good-quality water is a less viable option. One-third of the world's major cities rely on forests and wetlands for their drinking water, as well as for industries that require high-quality water.

Example 4: The "Drinking water forest" (Trinkwasserwald® e.V.), and its cooperation with BIONADE Corporation, Germany

In April 2008, Trinkwasserwald® e.V. (Drinking Water Forest Association NGO) started a project with the BIONADE Corporation for the sustainable production of drinking water. BIONADE, a privately owned German company situated in Bavaria, needs good-quality drinking water, for its organically manufactured non-alcoholic refreshment drink. The partnership has created over 63 hectares of "drinking water forests" throughout Germany and has sustainably generated 50 million litres of additional ground water, which compensates for the water used in the "BIONADE" product each year (Trink wasserwald® 2015).

(e) Temperature Regulation

9. With climate change a reality, powerful heatwaves are an issue of increasing concern in large cities, frequently resulting in deaths among vulnerable segments of the population. Wooded 'green' areas within cities form a vital source of cooling. Awareness of the cooling effect of green areas is often low in the general public, and green city areas can be seen as a luxury or tourist amenity.

Example 5: Uzbekistan Housing Report

The recent UNECE Uzbekistan Housing Country Profile produced in co-operation with the Uzbekistan Government, noted that the capital, Tashkent, was unusually green, with a total of 39,500 hectares of 'green space' within the city areas. This is a traditional response to the continental climate of Uzbekistan, with extremely hot summers in an arid environment.

The report concluded that, 'Cities should view the planting of trees as an environmental service: providing a cooling service as well as shade during the hot season, and protecting buildings during the cold season. Peripheral green belts are vital for maintaining urban resilience to climate change. Green urban infrastructure planning may be integrated in territorial development planning, to prevent risks related to heat and floods.'

2. Main Challenges in Practice

(a) Land-Use Competition

10. Existing forests are often protected, but if new forests are proposed to combat disasters these may be in competition with housing or infrastructure projects in highly desirable sites. For example, large green spaces work extremely well in Tashkent, but it is hard to see increasingly heatwave-prone London adopting the same strategy due to land prices. Likewise, riverside land is popular for both housing and industry, and flood-controlling forests will have to prove their case strongly against these competing needs.

(b) Forest Maintenance

11. Forests used for their ecosystem services may need maintenance to be kept in optimum condition. In many cases, the cost of this may be cheaper than the non-forest alternative (e.g. mass air-conditioning in cities, regular dredging of silted-up rivers), but it is more likely to be paid from dwindling government monies, making it a potentially unpopular political choice.

(c) Public Resistance

12. The Yorkshire experiment highlighted many of the problems with protective forest projects. There were strong local concerns that the loss of land from farms would lower the value of nearby land, and afforestation would block light and view for nearby residents. Furthermore it was seen as a cheap alternative to a more 'high tech' flood defence scheme which was more desirable to the residents. Whilst 'green solutions to environmental problems' may seem like an ideal answer to foresters, they can be viewed by many as cheap and unlikely responses to a problem which is believed to require a more technological solution.

3. Points for consideration

13. The Commission and the Committee may wish to:

(a) consider successful examples and lessons learned in enhancing forests’ contribution to disaster risk reduction and watershed management;

(b) identify practical challenges of and possible solutions for the valuation and monitoring of these forest ecosystem services;

(c) invite countries to better recognize forests role in disaster reduction and water management and strengthen cross-sectoral collaboration to include these services in landscape level policies and strategies.

(d) recommend UNECE and FAO to support countries in their efforts and identify priority areas for action.

III. Panel 2: Biodiversity Conservation

1. Snapshot – Current Situation

14. Biodiversity is not generally categorised as an ecosystem service, as it is the basis for all ecosystem services (UNEP, 2005). The role of forests in maintaining diversity of habitats as well as species and genetic diversity is indisputable: of all environments, forests have the richest biodiversity provision (Bastrup-Birk, 2015). Many forest species would not survive outside the environment to which they are evolutionarily adapted, so achieving the forest-related Aichi Targets will primarily require existing forests to be managed so as to conserve biodiversity.

15. The UNECE region has many good achievements in maintaining forest biodiversity. However, the massive deforestation which is a current concern in Asia and South America, has already occurred in this region. The expansion of agriculture, rapid growth of human population and industrial development led to centuries of deforestation with subsequent impacts on biodiversity, such as the loss of unknown number of species and retreat of others (e.g. bears, wolves and beavers) to smaller geographical areas and erosion of genetic diversity.

16. Throughout the UNECE region, most of forests are available for wood supply: for example, in Europe, the figure is 83 per cent. However, various biodiversity conservation measures have been applied to these forests but conservation is not their primary function. Other forests are generally managed for protective functions outlined above, or for biodiversity conservation.

17. However, in some cases, the objectives of timber production and biodiversity conservation tend to create conflict. Various strategies have been adopted: for example, in the UK, there are Species Protection Plans in place for any type of plant or animal which may be considered endangered, with attendant consequences for protection of habitat, signage, informing the public, infrastructure provision and so on.

Example 6: Capercaillie

The capercaillie is the largest of the grouse family of birds, and is found in the wild across Europe and Asia. In Scotland, numbers had begun to dwindle, due to challenging weather conditions, predation, over-grazing by other species, human disturbance of habitats, and deer fencing, with which the capercaillie collided (Trees for life 2015, RSPB 2015).

A Species Protection Plan dating from 1997 became a full recovery project in 2002 supported by EU funding. Habitat was improved by thinning the dense planted forests , increasing blueberry growth and providing additional ground cover. Legal control of predators (fox and crow) was promoted. Deer fences were removed where not needed and other fences marked to make them visible to the birds. Advice was offered to estates and land managers. The Caper-watch scheme allows members of the public to watch for capercaillie from a viewing hides and CCTV cameras during spring at the Loch Garten Osprey Centre. Caper-watch raises awareness of the conservation status of the species and reduces the risk of disturbance from birdwatchers. The 2004 national survey suggested that the population decline had been halted; with the population estimated to be about 2,000 birds. Unfortunately by the next national survey (of 2009/2010), the population stood at 1,285 and further measures were then taken by Forestry Commission Scotland in conjunction with the Royal Society for the Protection of Birds.

2. Main Challenges in Practice

(a) Reductions in Biodiversity

18. The increase in forest cover and attempts to conserve or increase species and habitat diversity, have been uneven across the UNECE region. Newly-established forests cannot make up completely for a loss of habitat from older forests, and there is evidence that traditional forest management methods can be in conflict with conservation of biodiversity. The EFI 'Integrate' project, for example, recommends that 'old growth' forests are maintained in order to create a baseline for comparison of biodiversity provision, and recommends a new 'integrationist' model of forest management. Laudable though this is, it has not yet been taken up throughout and the example below is more typical of the current situation.

Example 7: Biodiversity and Timber Production

The 'Woodland Management for Timber and Wood Products' report commissioned by the UK Forestry Commission and DEFRA in 2006, analyzed the impact of forest timber production on other public 'goods' such as recreation and habitat diversity. The hope always is for joint production, when the production of one good results in the production of another at reduced cost.

Whilst there was a positive correlation between forests managed for timber with recreation (as well-managed timber forests are pleasant to walk in), there was frequently a negative one between timber and biodiversity. This was not absolute: well-managed timber-producing forests are still a rich source of species and habitat diversity, but not as much so as forests which are managed for other purposes, for example conservation and recreation.

(b) Threats to Species diversity

19. Human activities continue to put pressure on the diversity of forest species through tourism, environmental degradation and game management, for example. There is a risk, even in an apparently healthy forest that the habitat of vulnerable species could vanish altogether or be so compromised that it cannot provide the quality of habitat required.

Example 8: Ecological Impacts of Deer Overabundance

Côte et al. (2004) reviewed research on the impact of deer populations in Europe and North America (Phys Org, 2015).

It was found that large deer populations inflict major economic losses in forestry (and agriculture) and contribute to the transmission of several animal and human diseases. The impact on natural ecosystems is less quantifiable – selective foraging affects the growth and survival of many herb, shrub, and tree species, modifying patterns of relative abundance and vegetation dynamics. Cascading effects on other species extend to insects, birds, and other mammals. In forests, sustained over-browsing reduces plant cover and diversity and alters nutrient and carbon cycling. These effects stabilize, and are then difficult to reverse. Given the influence of deer on other organisms and natural processes, ecologists should actively participate in efforts to understand, monitor, and reduce the impact of deer on ecosystems

Recent reports bear out the continued damage done to forests by overabundance of deer, with the Waller study in North America concluding that it may be decades before the damage can be undone.

(c) Air Pollution

20. Whilst the UNECE region is much ‘cleaner’ in terms of air pollution than it has been for decades, the problems of human airborne effluent, or other changes to the environment, continue to affect biodiversity.

Example 9: Impact of air pollution on forest biodiversity

Although air quality has improved considerably over the years, trees are still under stress (MCPFE and UNECE-FAO 2011). Knowledge of how air pollution damages forests tends to be restricted to a few well-known tree species and lichens. The impact of air pollution on birds or animals, and its long term effects on ecosystems, is less understood, as symptoms vary according to species and pollutants. The vulnerability of trees and forests to other pests can also increase as a result of chemical pollution.

Recently, ozone poisoning has become a problem in many regions. With its characteristic purplish-brown stippling on leaves, ozone damage is associated with forests near large urban sites such as Los Angeles. South-central European forests have been recorded as damaged by hard-to-regulate vehicle exhaust pollution (UNEP 2009)

The smelting industry continues to be a culprit for forest damages, especially in North America and the Russian Federation. Recent court cases in the USA have conclusively demonstrated the devastating effect that this industry can have if unregulated (Prunella, 2014). As soils are usually left heavily polluted by a range of chemicals, any clean-up is extremely difficult. While the type of direct injury to forests seen near smelters in North America and in lignite-burning areas of eastern Europe is unlikely to continue for much longer due to tighter emission regulations, air pollution-related damage to trees – much of it in the form of ozone – is likely to persist in these areas into the foreseeable future.

(d) Climate Change

21. Perhaps the greatest threat to biodiversity is the impact of climate change. According to the IPCC Fifth Assessment Report, the region has already experienced warming of .85° C, with attendant rains, droughts, floods, and higher sea levels.

22. This trend can only be expected to continue, with droughts leading to increased forest fires and desertification. Milder winters will lead to an increase in, especially, insect pests, where previously low winter temperatures may have been a significant factor in reducing over-wintering populations and limiting epidemics.

23. As temperatures rise, some species of plants or animals will lose their habitats, or be displaced from them by southern species which may extend their range to more northerly latitudes. Many temperate-zone insect species have shifted their distributions in response to recent climate change. Examples are the pine processionary moth (Thaumetopoea pityocampa) in Europe, winter moth (Operophtera brumata) and autumnal moth (Epirrita autumnata) in Scandinavia, and southern pine beetle (Dendroctonus frontalis) in North America (Régnière, 2009).

24. Finally, rising sea levels and the attendant risk of flooding of lowland forested areas, could lead to the greatest biodiversity loss in recorded history (Altlinger, 2009).

(e) Importing Biodiversity Threats

25. A combination of world trade and climate change has led to a number of non-native species being introduced to the UNECE region, with the result that they have displaced native species. In addition, forests are threatened by imported pests and diseases.

Example 10: Emerald Ash Borer Beetle in the USA

This beetle was discovered in south-eastern Michigan, USA in 2002. The beetle larvae feed on the inner bark of ash trees, disrupting the tree's ability to carry water and nutrients, and resulting in the loss of millions of ash trees in this area alone. It has since colonized over 15 other States, with tens of millions more tree losses, leading to quarantines and fines.

The beetle probably arrived in the US on solid wooden packing material from Asia, its region of origin (Emerald Ash Borer 2015).

(f) Fire Damage

26. A combination of climate-change induced temperature rises and a succession of droughts has led to an increased threat to biodiversity through fire.

Example 11: Fire Damage in the Mediterranean

Despite the well-publicized fires that severely affected the American West Coast, it is the biodiversity of the Mediterranean area which is most at threat from forest fires. Naturally, forest fires have always existed, and are used by many plants as a vector for propagation. Nevertheless, a combination of rising temperatures and droughts has produced devastating forest fires in the Mediterranean area. With climate change, the area is expected to become hotter and drier, leading to a higher frequency of large forest fires (EEA-JRC-WHO 2008; Flannigan et al. 2000, 2006; Loepfe et al. 2010).

The majority of fires are caused by human action. As population increases within this area (coupled with significant increases in tourist numbers), the incidence of anthropogenic fires can only be expected to increase.

While these forests will almost certainly grow back, the animal and plant habitats which have been lost will not necessarily return with them: once a species has lost its 'niche', the likelihood of colonization by an imported or rival species becomes much greater.

Many Mediterranean countries, notably Spain and Turkey, have responded with increasingly sophisticated fire-fighting measures. However, there is still a general lack of emphasis on fire prevention schemes across the area. These should include firebreaks, integration of fire-prevention measures into forest management and careful management of the human-forest interface, especially where housing has intruded into forest areas (Palahi et al. 2008).

3. Points for consideration

27. The Commission and the Committee may wish to:

(a) discuss the role of forests in conserving biodiversity;

(b) identify challenges of and possible solutions for better integrating biodiversity conservation into sustainable forest management at all levels;

(c) invite countries to consider appropriate actions to strengthen forests' contribution to preserving biodiversity including through the implementation of the Global Plan of Action for the Conservation, Sustainable Use and Development of Forest Genetic Resources;

(d) request UNECE and FAO to support countries in their efforts in this regard.

IV. Panel 3: Climate change mitigation, substitution and adaptation, and Forest and Landscape Restoration

A. Climate change mitigation, substitution and adaptation

1. Snapshot: Current Situation

28. **Climate Change:** With measured increases in global temperatures of around 1° centigrade over the period 1880-2012, it is generally accepted that deforestation is one of the land-use changes leading to increased carbon-based greenhouse gases in the atmosphere. However, just as deforestation can be a contributory factor in climate change, creating, restoring and managing forests can help to mitigate some effects.

29. **Mitigation:** The 2011 Bonn Challenge aims to globally restore 150 million hectares of deforested and degraded land by 2020. One positive effect of this would be climate change mitigation, by sequestering atmospheric carbon in new or restored trees. Newly-planted and restored forests have been highly successful at this, with 870 million tonnes of atmospheric carbon dioxide sequestered from 2005-2010. Current net positive rates of carbon sequestration in forests already help mitigate carbon emissions from other sectors, however, they may possibly be reaching saturation point, and further careful management may only bring diminishing returns. (Nabuurs et al., 2013).

30. Most member states have National Adaptation Plans (NAPs), aiming to protect forests and encourage efficient forest management in the context of climate change. Internationally, there are the commitments of the Rio Conventions, and the legal backing of Kyoto Protocol, as well as commitment to the carbon sequestration process through a number of binding treaties and ‘soft law’ agreements. These include ‘carbon trading’ schemes where carbon credits are transferred between countries.

31. As the UNECE region has already undertaken a successful reforestation programme, the main opportunities for further growth may be restoration of degraded forest land. In these areas, overgrazing or repeated setting of forest fires continues to limit the potential for full habitat restoration.

32. One other way in which increased forest acreage may be made more economically viable in the region, is greater use of forest products: using more wood energy, wood-derived materials and using wood to substitute for other materials. For example, wood-building techniques such as use of cross-laminated panels could substitute for unsustainable building materials like concrete and brick, leading to increased use of forests and, of course, locking up carbon in buildings and other long-term products, is also a way of sequestering. While the majority of global wood-energy schemes, biorefineries and wood-construction projects are taking place in the UNECE region, there is considerable scope for further growth in these industries.

33. **Biodiversity:** There have been great strides in understanding the impact of biodiversity on carbon sequestration. A core principle of sustainable forest management is that a biodiverse forest is a healthy forest, more likely to resist the impact of climate change, and continue sequestering carbon long into the future. The mechanisms for this include better resistance to invasive species, parasites and pathogens and increased biomass production, both of trees and soil organic matter.

34. **Adaptation and Substitution:** Biodiversity is also one of the key factors in adaption to climate change, as genetic diversity is the fundamental basis for the evolution of forest tree species. Selective breeding of species which cope better with, for example, higher temperatures or increased rainfall, becomes more possible the more genetically diverse the population of a particular species is. However, more drastic measures may need

to be taken if climate change continues at its current rate, and forest managers may have to use substitution methods: deliberate introduction of species better-adapted to the new conditions, in addition to changes in thinning operations, harvesting and drainage (Kolström et al., 2011).

2. Problems in Practice

(a) Legal Agreements

35. Despite the large number of treaties referring to forests as a tool in climate change mitigation, there still is no legally binding global or even regional agreement recognising the role of forest ecosystem services, or committing to action.

36. It is to be hoped that the planned Paris summit may lead to a change in this situation, but for the time being it is perfectly possible for individual countries to opt in or out of maintaining forests to mitigate climate change, as economics or policy dictate.

(b) Biodiversity

37. A healthy, well-managed forest is a desirable goal for both timber production and biodiversity. There is, however, no single model of sustainable forest management (SFM). The balance to be struck between different objectives will inevitably depend on what is seen as the forest's primary purpose. Under current forest management methods, maximising timber production would be likely to impact biodiversity and there comes a point where a trade-off between managing forest for carbon sequestration and storage, or for biodiversity needs to be sought (Kraus & Krumm, 2013). Whilst new integrative SFM approaches have been proposed which minimise this trade-off, the need to extract timber on an industrial scale may, at times, be incompatible with the requirement to leave sufficient undisturbed forest habitat for priority plant or animal species.

Example 12: Biodiversity, Carbon Storage and Dynamics of Old Northern Forests

In this 2009 document, the Nordic Council of Ministers reviewed all available literature and concluded that all North European forests benefit from a certain level of biodiversity (Framstad, 2009). Past this point, however, there is a trade-off between management styles that favour biodiversity, those that favour industry, and those that favour carbon sequestration. On the positive side, these differences in management can occur within one forest, with marginal areas being earmarked for biodiversity or carbon sequestration, and 'core' areas for harvesting of industrial timber.

These findings and approach are borne out by more recent research, notably Kraus, Schuck and Krumm (2013) in their paper 'Integrative Management Approaches: a Synthesis', which proposes new SFM practices using old-growth forests as a baseline comparison (Kraus & Krumm, 2013 pp., 256-268).

(c) Forests on Abandoned Land

38. In some areas, political and economic changes have rendered traditional agricultural land unprofitable, with the result that it has been abandoned. In many areas this has led to natural expansion of forest, going back to original land use, which would generally be seen to be a favourable consequence, adding to the growing forest area. However, there may be global and political problems with this process.

Example 13: Abandonment of Agricultural Land in Eastern Europe

Satellite data from Central and Eastern Europe and the Balkan Peninsula, showed that 8 per cent of the total land area (525,000 square kilometres) was abandoned farmland.

Whilst proportions and timings varied from one country to another, the pattern was consistent throughout.

The pattern of abandonment is correlated with socio-economic changes in the region, reduced or removed agricultural subsidies and so on, all of which changed radically with political change and the accession of several of these countries to the EU (European Commission 2013).

This issue is relevant to the reforestation debate because much of the abandoned farmland is colonized by trees from adjacent woodland. These new forests may help in meeting the Bonn Challenge, and certainly will sequester carbon.

(d) Low Take-up of Wood Alternatives

39. The technology for biorefineries as sources of valuable hydrocarbons, wood as a modern construction material and wood-derived fabrics in the textiles industry has existed for over 50 years. Despite this, for a number of reasons, the take-up of these solutions has been less than expected. Biorefineries have probably been the most successful, but even these have been hampered by economic factors (largely the continuing cheap price of oil, despite fluctuations) from being the anticipated major marketplace challengers. The potential for high-rise wooden buildings has been demonstrated in several countries, but timber still remains a material for construction with many competitors. Finally, the 'textile boom' in wood-derived fabrics such as viscose has also failed to come about, and may be a good example of the problem.

Example 14: Wood-Derived Fabrics

The 'Fabrics and Fashion' chapter of the 2014 Forestry Market Review examined the origin and market penetration of wood-derived fabrics (UNECE-FAO 2014). Viscose, for example, is manufactured using a number of environmentally-damaging chemicals, but is nonetheless far 'greener' than cotton if the chemicals are handled correctly. However, the public perception is that cotton, must be greener because it is 'natural' In addition, the textile industry is notoriously conservative, and continues to use cotton, even when its price rises above viscose. It has only been during long-term extreme cotton price rises that the industry has switched. This indicates that until oil-derived fabrics and cotton become much too highly-priced to use, designers and manufacturers will continue to use the materials they are most familiar with.

It is likely that similar forces of unfamiliarity and poor awareness are at work in the building and heating/energy sectors: innovative wood solutions are a less-well-known quantity, and only likely to be adopted at the point where the traditional solution becomes unavailable (as in Germany during the 1940s where biorefineries were used to replace hydrocarbon imports) or too highly priced (as with viscose during long-term cotton price increases).

(e) Wood Energy

40. Using wood for energy can be considered as sustainable and thus carbon neutral source of energy. The *"State of Europe's Forests"* reports highlight that the forest area, the growing stock, biodiversity and many other indicators of sustainable forest management have been improving since the Second World War. Energy and heating strategies have been used for some time in central Europe, and wood-energy strategies are being implemented in several Eastern European member countries. Despite these facts, fears of wood energy being one of the main causes for forest destruction in the world persist, in some cases with good reason. A second perception is that wood energy is the dirty fuel of the poor, causing

indoor and outdoor air pollution with negative impacts on health and climate. However Austria, Germany, Italy and other countries have shown, that wood energy can meet highest air quality and emission standards. One of the big challenges is how to make wood energy applications affordable, efficient and combined with other measures, such as appropriate storage, insulation, burning equipment and training of the users to adjust their habits.

Example 15: Massachusetts Decision

In 2012, the State of Massachusetts removed wood-burning power plants from a scheme that allowed 'green' power stations to earn extra revenue (NPR 2012). The grounds for this were that wood energy (which produces more electricity than any other 'green' method in the state) is not 'green enough'. In the short term, wood energy adds to atmospheric carbon, and, whilst in the medium term this will be sequestered by the forests grown to supply the wood-energy industry, this may take twenty years or more. During this time, the carbon continues to contaminate the atmosphere. Opponents of the measure argued that wood energy is generally derived from waste wood, which will generate just as much atmospheric carbon as it decays, and that a number of wood-energy power plants were built in good faith on the promise of extra revenue, but the decision currently stands.

It is clear from the above example that good evidence is required to demonstrate the 'greenness' of wood-energy against apparently 'greener' methods such as wind or solar (both of which require huge carbon footprints to set up).

3. Points for consideration

41. The Commission and the Committee may wish to:

(a) discuss the role of forests in mitigation of and adaptation to climate change;

(b) identify challenges of and possible solutions for better integrating climate change concerns into sustainable forest management at all levels;

(c) invite countries to consider appropriate actions to strengthen forests roles in climate change mitigation, adaptation and substitution wood for carbon emission material

(d) request UNECE and FAO to support countries in their efforts in this regard.

B. Forest and Landscape Restoration

1. Background

42. Deforestation and land degradation are major causes of biodiversity loss and significantly reduce the productivity of the natural assets upon which the well-being of humanity relies. Global estimates suggest that one quarter of global soils are degraded. This in turn negatively impacts the provision of ecosystem services, with approximately 60% (15 out of 24) of the ecosystem services examined under the UNEP Millennium Ecosystem Assessment being degraded or used unsustainably, including the provision of fresh water, food, fuel and fiber, air and water purification, and climate regulation.

43. Until recently degradation and its potential economic impacts have been largely ignored. This means that there is no standardized framework by which governments can assess and report on ecosystem degradation. Nevertheless even low-end conservative estimates reveal the significant scale and global reach of the problem. Evidence suggests that land degradation and conversion have led to the loss of between $4.3-20.2 trillion/year

in the value of ecosystem goods and services. This is equivalent to somewhere between 5% and 23% of the combined gross national product of all the world's countries combined.

44. Most indirect or direct drivers of forest and landscape degradation are human activities and actions that negatively impact lands and result in loss of carbon stocks. Agriculture (in particular commercial agriculture) is estimated to be the main driver of around 80% of deforestation worldwide. Mining, infrastructure and urban expansion are also important drivers of forest and landscape degradation. Findings on global patterns of forest degradation indicate that (commercial) timber extraction and logging activities account for more than 70% of total forest degradation in Latin America and (sub) tropical Asia. Fuel wood collection, charcoal production, subsistence agriculture, uncontrolled fire and livestock grazing in forested landscapes are also important drivers of forest and landscape degradation in several developing countries, particularly in Africa.

45. Consequently, continued forest and land degradation pose serious obstacles to eliminating poverty, hunger and biodiversity loss in many parts of the world and to the ability of women and men, farmers and local communities to adapt to the impacts of climate change. This degradation process also increases competition for scarce resources with possible conflicts between users and could exacerbate inequalities for certain groups, such as women, in relation to the use and control over these resources. These processes threaten the livelihoods, well-being, food, water and energy security and the resilience capacity of millions of people. Furthermore, continued forest and land degradation means continued atmospheric emissions of carbon and reduced capacity to sequester carbon/it, and increased risk of catastrophic changes to the earth's climate system.

46. Given the right tools and incentives, much of the deforested and degraded lands can be restored – that is, ecological integrity enhanced and human well-being improved through introduction and/or better management of forests, woodlands, trees and other woody plants at the landscape level. The Global Partnership on Forest and Landscape Restoration (GPFLR) has identified more than 2 billion hectares of deforested and degraded landscapes worldwide – an area larger than South America – where opportunities for forest and landscape restoration may be found. This represents areas where ecosystem goods and services are or could be delivered through the presence of forests, trees and other forms of woody biomass.

47. There is a growing awareness of the importance of forest and landscape restoration thanks to several international processes. The Bonn Challenge has set a target of restoring at least 150 million hectares of degraded land by 2020. Additionally, Parties to the Convention on Biological Diversity have adopted the Aichi Biodiversity Targets in 2010 – Target 15 calls for countries to restore at least 15% of their degraded ecosystems by 2020. At the 21st session of COFO in September 2012, member states recommended that FAO "identify its role in achieving the Bonn Challenge and strengthen its capacity in rural land-use planning in an interdisciplinary way through both normative work and project support to countries". Member states also recommended that FAO seek support for its field programme to increase assistance to member countries' capacity development in inter-sectoral planning, institutional development and the application of integrated approaches, and to continue engagement with the GPFLR.

48. Responding to these challenges and recommendations, FAO launched the Forest and Landscape Restoration Mechanism (FLR Mechanism) at the 22nd session of COFO in 2014, helping countries to achieve their commitments towards the Bonn Challenge, the Aichi Targets and related goals, catalyzing the work of the Organization in close collaboration with key partners in the context of the GPFLR.

2. Role of the FLR Mechanism – support to action on the ground

49. The FLR Mechanism supports the implementation as well as monitoring and reporting of FLR, in particular at the country level. It has so far received extra-budgetary funding from the Governments of the Republic of Korea and Sweden. Based on a multi-criteria selection process that was endorsed by the FLR Mechanism Advisory Group, several countries were selected to receive financial and technical support from the FRL Mechanism from the currently available funding. Factors such as existing pledges and commitment to the Bonn Challenge and alignment with the FAO Country Programming Framework were among the criteria used to determine the most eligible candidates. Countries selected so far to receive support during the period 2015-17 include Cambodia, Guatemala, Lebanon, Peru, Philippines, Rwanda and Uganda. A second group of qualified countries will receive funding if additional financial resources can be mobilized.

50. During the period 2015 to 2020 the FLR Mechanism will focus mainly on:

(a) Facilitating a multi-stakeholder process in selected countries to define needs and opportunities for FLR, resulting, as needed, in a national FLR plan that includes:

i) areas targeted for restoration;

ii) the potential roles and responsibilities of all actors;

iii) capacity development needs; and

iv) financial resources and technical support required and an indication of how to mobilize such support.

(b) Developing, compiling and disseminating tools and best practices related to FLR, taking into account existing related efforts (e.g., on land use planning, participation, genetic resources, biodiversity protection from pests and disease, fire management, water and soil conservation, landscape values, etc.).

(c) Supporting the establishment of pilot projects and helping broker new large-scale projects and programmes with national, bilateral and multilateral donors and the private sector.

(d) Supporting adequate quality control of well-established FLR efforts, to ensure compliance with accepted guidelines, norms and standards.

51. The FLR Mechanism is also working at the global level in:

(a) Developing, in collaboration with other partners, guidelines and standards for the establishment of baselines and the monitoring, measurement, reporting and verification of successful restoration efforts.

(b) Providing a financial intelligence function, identifying and making available to countries and implementing agencies information about sources of funding for FLR, as well as informing financial and donor institutions about the needs and opportunities for funding FLR.

(c) Contributing to the more effective embedding and reporting on FLR actions in global and regional commitments and processes.

(d) Helping to build and support operational partnerships on FLR, striving for increased intersectoral collaboration.

52. The FLR Mechanism works closely and in full complementarity with other FAO-hosted arrangements and programmes that have been set up to support related objectives, such as the UN-REDD programme, the Forest and Farm Facility (FFF), the Mountain Partnership Secretariat, the Globally Important Agricultural Heritage System (GIAHS)

initiative, the Land Degradation Assessment in Drylands (LADA) programme, the World Overview of Conservation Approaches and Technologies (WOCAT) and others.

53. The work of the FLR Mechanism is already embedded in the FAO's Strategic Framework, in particular the Strategic Objectives focusing on "increasing and improving the provision of goods and services from agriculture, forestry and fisheries in a sustainable manner" (SO2) and "increasing the resilience of livelihoods to threats and crises" (SO5). Under Strategic Objective 2, work of the FLR Mechanism is linked in particular to Output 20103, "Organizational and institutional capacities strengthened to support innovation and the transition toward more sustainable production systems". It contributes to the delivery of the Major Area of Work on Ecosystem Services and Biodiversity, as well as to the Regional Water Scarcity Initiative in the RNE region.

3. Funding/support

54. The FLR Mechanism is currently funded through extra-budgetary resources staff from external donors/partners - to date, these include the Republic of Korea and Sweden. It was established as an umbrella programme under which a variety of bilateral, multilateral and other types of support can be accommodated, mainly to support action at country level.

55. The FLR Mechanism is fully supportive of and synergistic with all efforts towards the achievement of the Bonn Challenge carried out by other GPFLR partners. Several GPFLR members are also members of the FLR Mechanism Advisory Group in order to ensure complementarity, mutual support and avoiding overlap or duplication in support to FLR globally.

4. Points for consideration

56. The Committee and Commission may wish to invite countries to:

(a) develop or strengthen mechanisms to ensure greater inter-sectoral cooperation amongst various land management agencies responsible for agriculture, forestry, fisheries and livestock management through a more integrated landscape approach;

(b) consider making pledges or commitments toward the Bonn Challenge, the Aichi Biodiversity Targets related to ecosystem restoration and other related goals and targets, and to support actions towards their achievement;

(c) consider strengthening the mobilization of innovative and enhanced levels of financing for the restoration of degraded lands, including through the GEF, the Green Climate Fund and the private sector, for which more favourable enabling conditions that promote investment may be required;

(d) provide financial and/or in-kind contributions to support the umbrella programme of the FLR Mechanism at FAO.

57. The Committee may wish to recommend FAO to:

(a) support country efforts to plan and implement activities related to the restoration of forests and other degraded lands, in particular through activities of the FRL Mechanism;

(b) seek further cooperation with partners to promote the restoration of degraded lands, in particular through direct involvement in global partnerships and initiatives, including the GPFLR, International Model Forest Network, and the Landscapes for People, Food and Nature initiative, as well as with the members of the Collaborative Partnership on Forests;

(c) engage in more cross-cutting and inter-departmental work, in particular through the relevant Major Areas of Work and/or Regional Initiatives defined under the FAO Strategic Framework, to support landscape approaches to achieve greater food security, poverty alleviation, climate change adaptation and mitigation, as well as the conservation and sustainable use of natural resources;

(d) pursue active engagement with multilateral, bilateral and private sector resource partners, including the GEF, Green Climate Fund and multilateral and regional development banks, to enable FAO to increase its support to member countries for capacity development in inter-sectoral planning, institutional development and application of landscape approaches on the ground.