Supplementary Information

1. Deforestation

Table S1. Empirical studies on deforestation included and analyzed in the review.

Deforestation									
No	**Indicator**	**Method**	**Proxy Indicator**	**Scheme**	**Findings**	**Time frame**	**Reference**	Country	**World region**
1	Low to no effect on deforestation within management unit; >1% (no effect/-)	Spatial analysis, statistical analysis	Annual forest loss	FSC	We find low forest loss inside the boundaries of each management intervention, with <1% lost over the study period (2000-2013). Certified and uncertified concessions had the same effect on forest loss rates. However, the uncertified concessions minimally lowered forest loss rates compared to matched control forests.	2000-2013	[1]	Cameroon, multiple study sites	Africa (3)
2	Reduction in deforestation, but low 1% (+)	Statistical matching method	Forest cover change	FSC	Rarely in this study were we able to reject the null hypothesis that FSC certification has no impact on forest loss. Certification significantly reduces the probability of forest loss by less than 1% (2000-2012). Therefore, the effects of FSC certification on forest loss are estimated to be very small.	2000-2012	[2]	Cameroon, multiple study sites	
3	Reduction in deforestation: 48% less deforestation yet not less than concessions with FMP (no effect)	Quasi-experimental, difference-in-difference approach, spatial analysis	Forest cover change	FSC	The area deforested is lower (74% lower between (2000-2010) in logging concessions that have an approved forest management plan (FMP) in the Congo	2000-2010	[3]	Congo Basin – except the Democratic Republic of Congo (DRC).	

					Basin. More specifically, in concessions with an FMP over a more extended period, deforestation is lower. Concessions with FSC certificates, testifying that FMP has indeed been implemented, have an average avoided deforestation estimated at 514 ha between 2000 and 2010. This represents 48% less deforestation in concessions that have received their FSC certificates between 2005 and 2010. Considering these limitations of the study and that concessions with FSC certification have had their certificates for at least five years, the complementary analyses suggest no statistically significant difference of deforestation across FSC-certified concessions and their peers with approved FMP that had no FSC certificate. Therefore, the additional benefit of issuing an FSC certificate over approval of FMP seems nonexistent compared to the overall impact of implementing FMP.				
4	No effect	Spatial analysis, interviews	Percent of forest cover loss and gain	FSC	There is no difference between certified and non-certified companies regarding forest cover loss from 2008 to	2008-2015; 2000-2012	[4]	Russia, Primorsky Krai	Asia (2)

				2015 or forest cover gain from 2000 to 2012.				
5	Reduction in deforestation: by 5% (++)	Quasi-experimental, spatial explicit econometric method	Forest cover change	FSC	Between 2000 and 2008, FSC reduced aggregate deforestation by 5 %.	2000-2008	[5]	Indonesia, Kalimantan	
6	Reduction in deforestation: 0.04% compared to 0.88% in uncertified concessions (+)	Spatial analysis	Annual deforestation rates	FSC	From 2002 to 2007, the average annual deforestation rate for the entire MBR is 0.88%, over twenty times higher than the deforestation rate for the FSC certified concessions (0.04%) (Table 2). Similarly, the average annual deforestation rate for the core protected areas (0.79%) is nearly twenty times higher than the rate for the FSC-certified concessions.	2002-2007	[6]	Guatemala, Maya Biosphere reserve	Central America (1)
7	No evidence/effect	Panel data techniques; matched difference-in-differenced models	Tree cover loss, regulatory permitting, and geophysical and socioeconomic land characteristics	FSC	The analysis results offer no evidence that FSC certification affects deforestation (2001-2012).	2001-2012	[7]	Mexico, several study sites across country	North America (1)
8	No difference/effect	Quasi-experimental, difference-in-difference model, spatial analysis	Tree cover loss	FSC	We find that logging concessions do not affect tree-cover loss on average, while the PAs reduce forest loss.	2000-2013	[8]	Peru, Amazon (Madre de Dios, Loreto and Ucayali)	South America (4)
9	Reduction in deforestation: between 2-23% (++)	Quasi-experimental, matched difference-in-difference	Natural forest conversion to plantations	FSC, PEFC-CER-FLOR, JSP	Properties with FSC certification tended to have lower historical deforestation rates than properties pursuing other	2001-2011	[9]	Chile, multiple sites	

		analysis, spatial explicit econometric method			nonstate, market-driven (NSMD) governance regimes. NSMD governance regimes reduced deforestation on participating properties by 2–23%. Our results indicate that FSC certification was more effective in slowing forest conversion than the more industry-friendly CERTFOR standard or the JSP moratorium.			
10	Indonesia: likely, Gabon: no change, Brazil, yes over longer time frame (no effect/+)	Synthetic control method (SCM)	Tree cover change	FSC	Certification likely did reduce deforestation in our case study FMU in Indonesia and likely did not in our case study FMU in Gabon. In our case study FMU in Brazil, the effect of certification varied over time. However, placebo tests show that this effect was insignificant in one case. In another case, it followed several years in which certification had the opposite effect (increasing tree cover loss).	2000-2012	[10]	Brazilian Amazon (orsa Florestal); Indonesia, Kalimantan; Gabon (Rougier landscape)
11	Peru: No average deforest impact in study area except one region (0.07% per year). Cameroon: No significant effect (0.02% per year in study area) (no effect/+)	Quasi experimental, spatial explicit econometric method	Loss of forest area	FSC	Peru: There is no average FSC deforestation impact in the study area (almost all concessions). One region, Madre de Dios, has an average reduction of 0.07% per year (2000-2013). Cameroon: Small average FSCC deforestation impact of 0.02% per year in our study area (all	2000-2013	[11]	Peru ((Madre de Dios, Loreto and Ucayali), Cameroon

					concessions), though there is no statistically significant effect in four of five regions.			

2. Forest degradation

Table S2. Empirical studies on biodiversity included and analyzed in the review.

Biodiversity								
No	**Method**	**Proxy- Indicator**	**Impact**	**Scheme**	**Findings**	**Reference**	**Country**	**World region**
1	Mixed-method, retro perspective quasi-experimental design	Tree (adult and seedling) species richness, diversity and density	Positive	FSC	Forest certification standards and implementation processes are positively related to biodiversity conservation. For example, there are significantly higher tree (adults) species richness, diversity, and density in certified community forests than in open access forests and state forest reserves. Data collected in 2013 static comparison.	[12]	Tanzania, Kilwa district	
2	Ape nest counts along standardized line transects using a before, during and after (BDA) methodology, General linear model	Species occurrence, gorillas, chimpanzees.	Positive	FSC	In addition to providing empirical support for the ecological needs of endangered African apes, these results convey feedback to forestry managers on the efficacy of reduced impact logging practices and certification schemes on wildlife. Line transects were surveyed twelve times between 2004 and 2012,	[13]	Congo, Kabo	Africa (3)
3	Spatially-explicit capture-recapture models to camera trap data to estimate density across a human land-use gradient at five sites in central Gabon	Population density of African cat	Positive	FSC	We found density was highest at a pristine, undisturbed site (16.23 [±5.84 SE] individuals per 100 km2) and lowest at a village site with moderate levels of mostly subsistence bushmeat hunting (3.8 [±2.23 SE] individuals per 100 km2). Logging concessions can support important densities of the species (10.18 [±3.54 SE] and 12.84 [±4.25 SE] individuals per 100 km2), with the higher estimate of the two for the concession certified by the Forest Stewardship Council	[14]	Central Gabon	

				(FSC) versus the non-certified concession. 2011-2013			
4	Camera trapping	Abundances of medium to large ground-dwelling vertebrates' differences between before and after harvesting by RIL.	Neutral	FSC	Mammalian density and species composition were not significantly different between pre- and post-harvested areas prior to RIL harvest. February 2008 to September 2009.	[15].	Malaysia, Borneo, Deramakot Forest Reserve	
5	Camera trapping in combination with community occupancy modelling	Mammalian diversity	Positive	FSC	Higher species richness (of threatened species) in certified forests Deramakot was sampled between September 2008 and January 2009, Tangkulap between April and September 2009 and Segaliud Lokan between January and April 2010.	[16]	Malaysia; Borneo Deramakot and Tangkulap and Segaliud Lokan Forest Reserve	
6	Heat camera-trapping sensors located in 29 plots at 5 km intervals throughout the two forest reserves	Effects of FSC-RIL of diversity of forest-dwelling medium to large-bodied vertebrate species at a landscape-scale based on a comparison between the two reserves.	Positive	FSC	The mean number of species recorded per plot was significantly greater in Deramakot (17.562.8; n = 20) than in Tangkulap (15.262.0; n =9) (P,0.05). Among the 36 species, six threatened species showed a significantly higher frequency per plot in Deramakot. June 2008 to April 2009	[17]	Malaysia, Borneo, Deramakot and Tangkulap forest reserve[1]	Asia (7)
7	Biodiversity observation for land and ecosystem health (BOLEH)	Forest intactness based on the tree-generic compositional similarity with that of a pristine forest (index of biodiversity).	Positive	FSC	Significant spatiotemporal changes in carbon and forest intactness during these five years reflected past logging intensities and current management regimes in these forests. Enhancement of these ecosystem services occurred in the forest where sustainable management with reduced-impact logging had long been implemented.	[18]	Malaysia, Borneo Deramakot and Tangkulap forest reserve	

[1] Deramakot is a sustainably managed forest with reduced impact logging, while Tangkulap is a forest damaged by conventional logging at the time of investigation (2001–2007).

					2009, 2014			
8	Fieldwork (report based on empirical data/results of project)	Reduced impact logging, biodiversity, richness and composition of canopy tree community	Positive	FSC	Positive impact on biodiversity: it can be concluded that RIL can maintain the richness and composition of the canopy tree community at a level equivalent to the pristine forest. 2003	[19]	Malaysia, Borneo, Deramakot forest reserve	
9	Field vegetation survey, statistical analysis (non-linear regression), modeling	forest structure and biodiversity, stem density, basal area, ecological integrity (total stand volume).	Positive	FSC	The tree species composition became diverse with age and began to resemble that of baseline forests around 25 years. Results suggest that the forest structure in secondary stands follows a natural regeneration dynamic over the rotation period but had not yet attained the same structure and composition as baseline forests at 25 years. Growth models suggest that the harvest rotation may need to be extended to 30–40 years for secondary stands to attain similar ranges of forest structure, compositions, and volumes to baseline forests. June to August 2015. A total of 28 transects were established	[20]	Indonesia, West Papua	
10	Statistical analysis, stakeholder workshop	Forest carbon storage, species richness	Positive	FSC	The study found higher carbon stock ($p<0.05$) and species richness and a lower ecological threat index ($p<0.10$) in the certified community forests compared to non-certified community forests. In addition, the study showed that forest carbon stock is positively related to species richness and negatively to the ecological threat index. February–May 2013	[21]	Nepal, Charnawati landscape in the Dolakha district	
11	Constrained ordination	Floristic composition, reduced impact logging	Positive	FSC	The highest abundance of light-benefiting taxa was found in certified forests, whereas conventionally managed forests were floristically more similar to natural forests. We found a lower floristic similarity between certified and natural forests than between conventionally managed forests and	[22].	Honduras	Central America (1)

					natural forests in the treefall gaps studied in northern Honduras. Based on the high abundance of pioneer species and gap environmental variables indicating a reduced disturbance in the certified forests, we suggest that factors such as past loggings, hurricanes, and the location of the forests in relation to seed sources may have a more significant impact on forest structure than implementing certified management practices.			
12	Stream Visual Assessment Protocol (SVAP)	Elements of Stream Visual Assessment Protocol (SVAP): Channel condition, Hydrologic alteration, Bank condition, Riparian area quantity, Riparian area quality, Canopy cover, Water appearance, Nutrient enrichment, Manure or human waste presence, Pools, Barriers to aquatic species movement, Fish habitat complexity, Aquatic invertebrate habitat	Positive	FSC	Forest certification positively affected the ecological condition of the surveyed streams, but its effects were only measurable after five years of certification. Streams with five years of certification had more continuous, dense, and diverse riparian vegetation when compared to streams located in non-certified areas. The condition of streams located in areas with five years of forest certification was similar to the condition of least disturbed streams 3-5 years.	[23].	Portugal, subbasin of the Tagus River; Mediterranean evergreen oak woodlands.	Europe (13)
13	Assessment of logging damage in established plots over a year	Green tree retention, Buffer zones in riparian habitat, Swamp forest, Preservation of precutting coarse dead wood, Terrain damage	Mixed	PEFC	This study pinpoints specific in-the-field improvements considered a result of forest certification, such as increased retention of trees and wider buffer zones in riparian forests. However, the study also documents that many regeneration units cut after forest certification still do not comply with all the forest certification criteria. Therefore,	[24]	Norway, South	

		resulting from off-road transport			it is difficult to separate the pure effect of forest certification from the effect of generally increased awareness of sustainable forestry during the period of this study. 1998, 118 areas cut before the implementation, in 19961997, were compared with 118 areas cut a few years after implementation, in 2001 2003		
14	Literature review, review of public summery reports and CAR´s issued on HCFV	BiHCFVs e.g. ecosystem services, soil erosion, conservation of threatened, endangered and endemic species.	Positive	FSC	Conservation gain in HCVF, especially related to ecosystem services. Prevention of soil erosion and conservation of threatened, endangered, and endemic species. 2005-2008	[25]	Bosnia-Herzegovina and Romania
15	Use of survey databases of the Estonian State Forest Management Centre to preselect old-growth stands based on their site type, size (≥2 ha), and the estimated age of dominant canopy trees (>120 years). Four groups of forest site types arranged along soil richness and moisture gradients considered	Abundance of live trees, standing deadwood, and regeneration, Abundance of flying deadwood, tree-species diversity and composition.	Positive	FSC	Many functional characteristics of old-growth forests were present in the FSC-certified, mostly naturally regenerated, commercial stands. The main problem is the lack of very large trees, particularly late-successional deciduous species. No info on time frame	[26]	Estonia
16	Morphological spatial pattern analysis, habitat suitability	Area proportion of set-aside forests, structural habitat connectivity, potential	Positive	FSC	FSC certification does contribute to biodiversity conservation, but the level and efficiency of this contribution depend on standard content and how it is implemented on the ground. At	[27]	Sweden; North-West Russia

	index modelling	functional habitat connectivity			the same time, the role of national legislation or policy for biodiversity conservation remains critically important. Consequently, to understand the effects of conservation efforts in managed forests, both informal and voluntary set-asides need to be considered. No info on time frame		
17	Comparison of species richness and irreplaceability value of certified and non-certified cells	Species richness, irreplaceability value	Neutral/no effect	FSC	The biodiversity value of certified areas was not significantly greater than that of non-certified areas. gathered biodiversity data for 86,582 ha of cork oak savannas that were FSC certified between 2007 and June 2011	[28]	Portugal, Coark oak savannas
18	Analysis of corrective action requests (CARs) raised by certifying bodies		Positive	FSC	Increased amount of biotope trees, deadwood, habitat for endangered species, and the quality by using trees with a large diameter, increased use of hardwoods, ban of exotic species	[29]	Estonia
19	Topographic density surface models, Distance sampling method for estimating population density based on surveying a number of randomly located transects.	Cover, richness and diversity of Mediterranean shrublands.	Positive	FSC	In conservation zones, oak regeneration was more abundant, and species richness and diversity of shrubs were significantly higher. Our results suggest that creating set-aside areas in cork oak woodlands, such as conservation zones, may help avert this ecosystem's tree regeneration crisis. No information	(Dias et al. 2016)	Mediterranean cork oak, Southern Portugal, Alentejo region
20	Morphological spatial pattern analysis, habitat suitability index modelling	Area proportion of set-aside forests, structural habitat connectivity, potential functional habitat connectivity	Mixed	FSC	FSC certification alone could not maintain forests' structural and functional connectivity for species at multiple spatial scales in Lithuania. By keeping a minimum standard of 5 % forestland set aside for biodiversity, the state forest enterprises certified according to the FSC can only satisfy forest species with small habitat requirements.	[30]	Lithuania

					Data taken from 2004		
21	Analysis of forestry inventory data	Structural diversity of landscapes. i.e., dead wood, large trees, and the broadleaved tree species aspen, rowan and sallow	Positive	FSC	Certification improved the structural diversity of landscapes used NFI data for the time period 2009–2013 from a total number of 7993 (639 VSA, 553 R, 6801 PF) plots.	[31]	Sweden
22	Systematic research, spatial analysis, field measurements, principle component analysis, ANOVA	Ecological effectiveness/ecological integrity	Negative	FSC	Limited positive effect; according to the Russian FSC standard (and legislation), it seems acceptable to exploit primeval forests by creating large-scale clear-cuts. Quite a few FSC-induced measures seem to induce minor improvements. For example, substantial clear-cuts of 50 hectares or more, after a few years covering much larger areas of consecutively cleared forest. However, there is no evidence for either decreased or avoided large-scale degradation of forest cover in certified areas. Data on annual tree cover loss between 2001 and 2014 [50] was used to look at logging patterns and to calculate tree cover loss before and during FSC certification, as well as in the forest landscape outside of FSC-certified concessions. Maps on the spatial distribution of FSC-certified forest management units (FMU) as of May 2016 [51] were processed	[32]	Russia, Arkhangelsk Region
23	ECOsystem-based assessment of Sustainability standards and their effects (ECOSEFFECT) framework, semi-quantitative	Living tree biomass, dead-wood, rejuvenation, vegetation, and microclimate regulation	No effect of FC	FSC	There were very few substantial differences between FSC-certified forestry operations to conventional ones. This can be explained by the equally high amounts of harvested timber (ca. 97% extracted) as well as the practice of large-scale clear-cutting (up to>50 ha), generating significant structural and functional ecological changes in	[33].	Russia, Arkhangelsk Region

	evaluation, theoretical plausibility analysis, spatial analysis			the forest ecosystem. However, the findings suggest no real change in forest operations towards ecologically responsible harvesting. Instead, FSC-certified forestry contributes to the ongoing loss of primary forests in the remaining Intact Forest Landscapes.			
24	Analysis of official forestry inventory data, Impact evaluation methods	Richness, availability (density) and dominance of potentially suitable cavity trees for secondary cavity-nesting birds. three control sites	Positive	FSC	Logged forests under FSC-certification may guarantee a diversity, availability (density), and dominance of potentially suitable cavity trees for secondary cavity-nesting birds, as well as specific characteristics (such as DBH > 40 cm), similar to unlogged forests for this group of birds. Field sampling was conducted from 2014 to 2016 at seven sites located in Salta and Jujuy provinces:	[34]	Argentina, North west	South America (2)
25	Camera trap surveys	Presence of jaguars (densities) and its prey,	Positive	FSC, PEFC	In all twelve sites in four Latin American countries, we found jaguars and reasonable assemblages of their prey which are success stories of maintaining jaguars in managed forests where certification has been initiated. Certified forests can provide jaguars an opportunity to survive outside protected areas. Surveys were implemented successively in the four sites in 2007–2010 during the September–December dry season	[35]	French Guiana, Guatemala, Bolivia, Nicaragua	

Table S3. Empirical studies on carbon stock and emissions included and analyzed in the review.

Carbon stock and emission								
Number	**Method**	**Proxy - Indicator**	**Impact**	**Scheme**	**Findings**	**Reference**	**Country**	**World region**
1	RIL-C monitoring protocol to quantify logging emissions and potential emission reductions	Reduced impact logging, carbon emissions	No difference	FSC	Emissions from concessions certified by the FSC (FSC, N=6) and those not certified (N=17) did not differ. There was no indication that FSC certification was associated with reduced emissions. No information on time frame	[36]	Congo, Gabon	Africa (1)
2	Fieldwork (report based on empirical data/results of project)	Reduced impact logging, carbon storage, biodiversity	Positive (accounted for in biod)	FSC	RIL effectively sequesters a more significant amount of carbon in the above-ground vegetation. 2003	[19]	Malaysia, Borneo, Deramakot forest reserve	
3	Heat camera-trapping, amount of above-ground, fine-roots, and soil organic carbon by a combination of ground surveys and aerial-imagery interpretations	Reduced impact logging, carbon sequestration/density, biodiversity (diversity of vertebrates)	Positive	FSC	The carbon estimation revealed that the application of SFM resulted in a net gain of 54 Mg C ha-1 on a landscape scale. 2001-2007; 1985–2002 (historical disturbance intensity compared)	[17]	Malaysia, Borneo, Deramakot and Tangkulap forest reserve[2]	Asia (5)
4	Spatial analysis, field sampling, emission calculations, statistical analysis	Reduced impact logging, carbon emissions	Mixed: No difference, only in one case effect	FSC	Concessions certified by the Forest Stewardship Council (FSC, N = 3), when compared with noncertified concessions (N = 6), did not have lower overall CO2 emissions from logging activity (felling, skidding, and hauling). On the other hand, FSC certified concessions	[37]	Indonesia, Kalimantan	

[2] [2] Deramakot is a sustainably managed forest with reduced impact logging, while Tangkulap is a forest damaged by conventional logging at the time of investigation (2001–2007).

					did have lower emissions from one type of logging impact (skidding). No information			
5	Statistical analysis, stakeholder workshop	Forest carbon storage, species richness	Positive (accounted in biod)	FSC	The study found higher carbon stock ($p<0.05$) and species richness and a lower ecological threat index ($p<0.10$) in the certified forests compared to non-certified forests. collected data from each plot during February–May 2013	[21]	Nepal	
6	Biodiversity observation for land and ecosystem health (BOLEH)	Forest intactness based on the tree-generic compositional similarity with that of a pristine forest (index of biodiversity). Carbon stock.	Positive	FSC	A significant increase in mean carbon density value and a marginally significant increase in mean forest intactness value in Deramakot between August 2009 and June 2014 2009, 2014	[18]	Malaysia, Sabah	
7	Statistical analysis, regression	Reduced impact logging, carbon emissions of felled trees	Positive	FSC	Our analyses indicate that FSC certification was not associated with any difference in carbon emissions from selective logging but that employment of RIL practices resulted in fewer damaged trees and lower carbon emissions even in ejidos with high logging intensities. Forest disturbance from logging operations in the 2013 ACAs of Caobas and 20 de Noviembre were sampled between January and April 2014; for the other eight ejidos, we sampled the 2014 ACAs during March-November 2015.	[38]	Mexico, Yucatán Peninsula	North America (2)
8	Allometric equation to obtain biomass in tropical dry forests. Data collected	Reduced impact logging, total tree biomass, carbon emissions	Positive	FSC	Selective logging generated 1.2 Mg m-3 and 1.5 Mg m-3 of total carbon emissions in the Caobas and 20 de November ejidos, respectively, with 5% and 12% corresponding to collateral damage during felling. Overall lower committed emissions and	[39]	Mexico, southern Yucatan Peninsula	

	during field sampling used to estimate the impacted aboveground biomass and calculate carbon emissions from selectively logged areas.				collateral damage from felling and skidding were present in Caobas, the FSC certified ejido. January and April 2014.			
9	Field work, emission calculations	Reduced impact logging, carbon emission/export in whole logs and carbon accumulation as coarse woody debris (CWD) produced from forest damage	Mixed	FSC	Certified timber harvest in Amazonia under RIL is a viable forest management option to reduce damage and coarse woody debris production compared to conventional logging (CL) practices; however, the benefits of disturbance reduction from RIL relative to CL are only realized at greater volumes of timber extraction. 2003, 2004	[40]	Brazil, Amazonia	South America (2)
10	Field work, emission calculations, statistical analysis	Reduced impact logging, carbon emissions from felling, skidding, and hauling in five FSC-certified concessions	Positive	FSC	Total carbon emissions per hectare were greater in non-certified FMUs compared to certified ones. 2014	[41]	Amazonia, Peru, Madre de Dios	

Table S4. Empirical studies on forest structure included in this review.

Forest Structure								
Number	**Method**	**Proxy indicator**	**Impact**	**Scheme**	**Findings**	**Reference**	**Country**	**World region**
1	Field based study, comparisons of a single FSC-certified	Tree species density and composition.	Positive	FSC	For each tree felled, an average of 9.1 and 20.9 other trees were damaged in the FSC and CL plots, respectively; when expressed as the impacts per timber volume extracted, the values did not differ between the two treatments. Skid trails	[42]	Gabon	Africa (2)

	concession with an adjacent non-certified concession				covered 2.9 % more of the CL surface, but skid trail length per unit timber volume extracted was not more significant. Logging roads were wider in the CL than in the FSC site and disturbed 4.7 % more of the surface. Overall, logging caused declines in AGB of 7.1 and 13.4 % at the FSC and CL sites. Logging damage was assessed in January–February 2011.			
2	Systematic sample plot forest inventories were used to collect data on forest structure and human forest use indicators; participatory rural appraisals (PRA) and household surveys were used to collect data and information on forest governance and institutions indicators.	Forest structure and human forest use indicators	Positive	FSC	The FSC-certified forests have better forest structure, appropriate regeneration, and lower fire incidences than open access forests and state forest reserves. No data	[43]	Tanzania, Kilwa District	
3	Field surveys, circumference method	Structure and composition of plant communities	Positive	FSC	Forests logged selectively under certified regimes still have a high plant diversity, possibly indicating that biodiversity values may be conserved by following certification procedures. No information	[44]	Indonesia, East Kalimantan	Asia (2)

4	Field vegetation survey, statistical analysis (non-linear regression), modeling	Stem density, basal area, ecological integrity (total stand volume).	Positive *Double counted with biodiversity*	FSC	Results suggest that the forest structure in secondary stands follows a natural regeneration dynamic over the rotation period but had not yet attained the same structure and composition as baseline forests at 25 years. Furthermore, growth models suggest that the harvest rotation may need to be extended to 30–40 years for secondary stands to attain similar ranges of forest structure, compositions, and volumes to the baseline forest. Field surveys were conducted from June to August 2015	[20]	Indonesia, West Papua	
5	Interviews, field visits, State Forest Management Centre (RMK) staff questionnaire visits	Soil damage, amount of dead wood, dead snags, no of life biodiversity trees, damage to remaining trees, presence of buffer zones along open landscapes and watercourses, signs of garbage or pollution on the site, compliance of felling area borders with the felling site borders on the map, and changes in water regime of water courses as a result of felling activities. Perceptions	No effect	FSC	Certification has not reduced the share of clear-cut free forestry or increased the preference for mixed stands, as hoped by many stakeholders. Biological elements were presserved on clear-felling sites. Field visits November 2004, interviews February 2004	[45]	Estonia	Europe (4)
6	Analysis of datasets, mail survey	Presence of dead wood, broad-leaved trees and old forests.	Negative	FSC, PEFC	Our analysis indicates minor improvements in forest conditions, corresponding with the interim target for enhanced biological diversity (dead wood,	[46]	Sweden	

					broad-leaved trees, and old forests). The improvements were less evident on large-scale forest properties (certified under the FSC) than small-scale private forest properties (mainly certified under the PEFC). However, results from the follow-up survey showed that more harvesting activity had taken place on certified small-scale forest properties than on noncertified ones. This could mean more negative effects on biodiversity. Data for the periods 1998–2002 and 2003–2007 were analyzed and presented as estimated mean values for 2000 and 2005,		
7	Datasets, Phone Survey, Descriptive statistics	Effect of certification on the preservation of environmentally important areas during felling, number of trees and high stumps remaining in the plots 5- 7 years after felling, certifications' area set aside for area requirement to set aside at least 5% of the total forestland for conservation purposes. (1992-2010)	No effect of FC	FSC, PEFC	We found that 64% of the inspected plots do not comply with environmental considerations, implying that most sensitive habitats are not saved during felling. Compared to the performance of similar noncertified forest owners, the certification has not led to any additional improvements in these outcomes. Hence, it has not contributed to reducing forest degradation in Sweden. Based on the regeneration monitoring dataset for the period 1992–2010.	[47]	Sweden
8	Quantitative, we distinguished between areas with no history of certification (non-	Use of available data on tree cover loss and satellite images to assess secondary impacts of clearcuttings on adjacent remnant forests	No effect of FC	FSC	The study confirms doubts that the Forest Stewardship Council is an appropriate mechanism for safeguarding ecologically responsible forest use in Russian forests. Furthermore, the Russian National FSC Standard fails to induce ecologically friendly	[48]	Russia, Arkhangelsk Region

	FSC in the following) and forests that had been managed before they became certified (before-FSC in the following) and subsequently under FSC (during-FSC in the following).	and to quantify the logging intensity. Additionally, the size and structure as well as the density of skidding trails of ten specific clearcuttings located within the sample area were surveyed using satellite images and in the field observation to delineate the boundaries of clear cuts and forested remnants within the clear cuts.			cutting and harvesting methods in the studied area. Within a sample area delineating approximately 3000 km2 in the east of the Arkhangelsk Region, data generated by Hansen et al. (2013) on changes in global forest cover between 2001 and 2014 was used to calculate annual tree cover loss and the size of clear-cuts in relation. FSC concessions as of 2016.			
9	Forest inventory plots on the three uncertified harvested and three certified harvested properties, calculation of Coarse Woody Debris Volumes, statistical analysis	Total tree biomass and tree carbon storage.	Neutral/No effect	FSC	Overall, our data suggest that FSC-certified harvested stands in northern hardwood forests have similar sugar maple timber value, aboveground live tree carbon storage value, similar live tree structure, and greater residual coarse woody debris than uncertified harvested stands. Forest inventory plots were established during June-July, 2004	[49]	USA, Vermont	North America (1)
10	Use of Landsat-remote sensing data to detect logging activity/ detect logging activity and	Non-permanent opening in the canopy as the main indicator of forest degradation due to logging.	Positive	FSC	Our indicators showed that the patterns of forest disturbance through time are much more favorable for forest cover inside a logging company with an FSC certified forest management plan than outside, where many actors mine the forest resources without any concerns for future stocks. This showed the efficiency of the RIL techniques	[50]	Brazil, Paragominas	South America (1)

to analyze the spatial arrangements of the impact	and the FSC certification requirements to reduce the impacts of logging in terms of canopy openings. Landsat images of the period 1994–2009	

3. Economic viability

Table S5. Empirical studies on the economic viability included in this review.

Economic viability										
Number	**Method**	**Proxy- Indicator**	**Impact**	**Scheme**	**Findings**	**Reference**	**Forest type**	**Price premiums**	**Country**	**Word region**
1	Questionnaire survey	Cost-benefits	mixed	FSC	Most of the respondents indicate that the benefits from certification will offset the costs. However, some farmers feel that the costs are too high and that the benefits derived from certification do not justify the means.	[51]	Plantations	---	South Africa	
2	Economic/financial valuation	Price premiums, profitability	negative	FSC	Group of CF currently is not economically viable, with forest management costs 2.6 times forest revenues over the five-year study period. 2013–14 to 2017–18.	[52]	Natural	20% Pulpwood roundwood stumpage	Tanzania, south eastern (incl. Kilwa)	
3	Value chain analytical framework, mixed methods for data collection: participatory rural appraisal (PRA) for key informants, and household survey for all actors, semi-structured interviews, structured questionaires	Price premium, Revenues, household income	positive	FSC	Actors from certified forest communities earned higher income (net revenues) than non-FSC forests and experienced significantly greater income equity. This finding suggests that forest certification is an important forest management approach in enhancing equity in income distribution among the actors.	(Kalonga et al. 2015b)	Natural	--	Tanzania, Kilwa district	Africa
4	Economic valuation, governance indicators	household income	positive	FSC	Results show that the annual average household forest income from FSC-certified forests is significantly higher than households in non-FSC-certified forests. Forest	[53]	Natural	--	Tanzania, Kilwa district	

					incomes contributed about 12% and 6% for FSC-certified and non-FSC-certified forests to total household income, respectively. FSC offers an opportunity for 'price premium.' The certified VLFRs are exposed and connected to international markets, whereby certified forest products fetch high prices, but the local markets are unaware. Incomes earned from the forests were spent on procuring farming implements and fertilizer, pesticides, and investing in other income-generating activities such as small shops vegetable gardens. The 95 % revenue of the FSC villages was spent for forest protection (40 %) and community development projects (55 %) such as water, health, and education.					
5	Cost-benefit analysis, interviews, collection of secondary data	Price premiums, cost-benefit	positive	FSC	The production cost and return of FSC rubber plantations were similar for all sizes of rubber plantations, with the larger plantations having the highest rates of return. economic viability increased with time being certified, decreasing cost and increasing revenue.Currently, much of the cost of certification is met by external aid donors.	[54]	Plantations (rubber)	No premium	Thailand, Rayong and Songkhla	Asia
6	Interviews, analysis of	Price premiums,	negative	FSC	When the total costs of certification are	[55]	Plantations	--	Japan	

	public assessment reports	profitability			included, the benefits to growers of certification are much reduced and potentially negative unless the fixed costs can be spread over a large group of growers.		(Japanese larch, hinoki cypress, Japanese red pine)		
7	Interviews, collection and analysis of archival data, including forest management records from forest management sites and reports by the aid contractors	Price premiums, revenues and sales	positive	FSC	The final price differential is very pronounced, comparatively high premiums and net revenue earned by FSC smallholders.Without continued donor support, it is not clear that the farmers in Quang Tri can afford the auditing fees required to maintain the group certification. Price premium up to 24% for Acacia in 2010, probably not sustainable for the long term. O5	[56]	Plantations (Acacia)	24%	Vietnam, Quang Tri
8	Household survey, standing stock estimation, financial analysis	Price premiums, profitability	positive	FSC	Vietnam forest plantation investment returns for smallholders are profitable. This was helped by proximity to regional countries with high demand for wood products, creating some of the world's best roundwood pulp/chip prices. - Pulpwood roundwood stumpage sold for around US$ 12 /m3 in 2015 for much of the world such as the US South, but prices in Vietnam were closer to US$ 40 /m3. This is largely because they sell directly to countries with high	[57]	Plantations (Acacia)	--	Vietnam, Quang Tri

					demand, such as China and Japan (20% price premiums				
9	Examination of reports/evaluation and feasibility studies, interviews with government department and WWf staff, SWOT analysis	Price premiums, direct and indirect cost	positive	FSC	For annual audits, the fee is approximately $7,000 – amount beyond the capacity of local people, as their annual income is only around $1,000 per capita. - Indirect costs for certification such as buying forestry machines (saw), first aid kits, and working clothes are also costly. - Premium was recorded and confirmed by 19 households who sold the wood in 2010 though revenue differed among households according to plantation area and rotation leng Price premiums 19-22% price difference between certified and non-certified wood FSC certification Increased selling price for farmers and extended trade networks.	[58]	Plantations (Acacia)	19-22%	Vietnam Quang Tri province
10	Interviews, Cost-benefit analysis	Price premiums, revenues and sales, household income	positive	FSC	Total costs decreased with increasing ha certified. Certification associated costs are currently covered, and the household members do not need to pay for any cost, with the exception of the contribution fee which is collected after selling FSC certified timber (price premium 18%) 2010–2016	[59]	Plantations (Mostly acacia)	18%	Vietnam Quang Tri province
11	Review of secondary data,	Price premium,	positive	FSC	Acacia hybrid timber plantations account	[60]	Plantations	12%	Vietnam, Phu Loc,

	interviews, focus group discussions, direct observations, surveys, statistical analysis	household income			for 33–56% of total household income. Play a crucial role in the current livelihood system. Timber income skewed toward the wealth status of timber producers and ranged between 327 USD/household and 9460 USD/household in Phu Loc district. Despite the substantial contribution the income from Acacia hybrid plantations could make to local poverty reduction, it was the main contributor to the overall income inequality				Nam Dong
12	Analysis of primary data were taken from farmers, a SFC, and several other forest stakeholders including people from government departments and non-governmental organizations. Records of costs and benefits for farmers; formal and informal interviews with key informants	Profitability (financial returns)	positive	FSC	Net returns from both certified and non-certified timber products are positive for both actors and are higher from certified timber production than non-certified timber production à plantations are profitable	[61]	Plantations (Acacia)	--	Vietnam Quang Tri province
13	Interviews, collection of secondary data (i.e. reports, books, provincial department of forestry) Cost-	Price premium, cost-benefit	positive	FSC	the financial returns from certified forest products are much higher than for non-certified forest products for the farmer, both at 7% and 12% interest rates	[62]	Plantations (Acacia)	25%	Vietnam Quang Tri provinde, Trung Son commune, GioLinh district

	benefit-analysis (CBA)								
14	Price analysis. Time series of prices of certified and uncertified logs (2000 to 2004) provided by three forest management	Price premiums	negatve	FSC	The higher sale prices of certified logs found in this study cover the additional direct costs of forest management certification, which range from 0.5 to 2.5 USD/m3/year. - This result however does not suggest that the achieved market premium will also offset the costs of sustainable forest management, e.g., for enhanced planning procedures and improved field operations 2000 to 2004	[63]	Not specified	2-56% depending on the wood: - The high-quality hardwoods (e.g. Selangan Batu, Keruing) destined for the export market fetch a price premium of 27% to 56%. - Lower quality timbers (e.g. Kapur, Seraya) also fetch a price premium, however the difference is less pronounced (2% to 30%)	Malaysia, Sabah
15	Questionnaires with forest authorities, field observations, literature review	price premiums, household income/livelihood	positive	FSC	Certification is perceived as a vehicle for local value addition. However, progress in income and employment generation and rural poverty reduction was insignificant. The durability of certification programmed skeptic because it was on a small scale, facilitated by external	[64]	Not specified	Yes, but premium was unspelled. Prices increased by 50-150%	Nepal

					supports and lack of national certifier. FSC supports national and international market access to Europe and the US; Price premiums (the price of products increased by 50–150 %). 2003 to 2008					
16	Quantitative survey with in-depth formal interviews; qualitative survey with open-ended questions to government and local NGO staff	Household income	positive	FSC	This study reveals that FSC group certification in Southeast Sulawesi could improve local incomes and social attitudes and could strengthen farmer groups to manage existing community forests more effectively. July to December 2008	[65]	Not specified	--	Indonesia, South Sulawesi	
17	Discounted cash flow analysis	Profitability, financial viability	negative	FSC	Non-chemical control methods were expensive relative to other regimes. - Reductions in the internal rate of return varied across low- and high-productivity sites between 0.8% and 0.5% for manual control, 1.3% and 0.8% for mechanical control, and 1.7% and 1.0% for weed mats. Meeting the goals of certification while retaining cost-effective vegetation control presents a challenge to the plantation forestry sector. survey 2005 to 2007	[66]	Plantation	--	New Zealand	Oceania
18	Financial assessment, comparing present values of financial returns, net of costs, of the forest activity 'with and	Profitabiliy (net financial profit)	positive	FSC	A minimum of group with 3000 ha may be required to make certification cost effective. 1997 to 2002	[67]	Plantations	--	Salomon Island	

	without' certification.									
19	Literature review, Expert Interviews, cost-benefit analysis	cost-benefits	negative	FSC, PEFC	Revenues appeared to be increasing and costs decreasing over the period, and in the final two years costs were about 1.5 times revenues	[68]	Not specified	--	Switzerland	
20	Semi-structured interviews, Delphi method, contingent valuation (Perceptions)	price premiums	negatve	FSC, PEFC	The majority believes that certified wood is sold at the same price than non-certified wood (of 33 valid responses, 88% considers that price does not change while 12% believe that price increases). Experts with a high degree of consensus (87.5% of a total of 32 valid responses) believe that normally certified and uncertified products are sold at the same price. Forest owners have to bear the certification costs themselves	[69]	Mixed: primary forests, semi-natural forests or plantations	No premium	European Union	Europe
21	Questionnaire survey (perceptions)	profitability	negative	FSC	In the Czech Republic, certification costs of the FSC were higher than financial revenues. However, the effect of the certification on sales, profits, and added value of companies seemed more effective over a longer timeframe (from 4 years to >10 years). 2016 and 2018 survey	[70]	Not specified	--	Czech Republic	
22	Survey	price premiums, direct and indirect costs	negative	FSC	The survey did not find additional sales of timber or price premium because of possessed certificate of good forest management. [71]Costs per hectare	[72]	Semi-natural	No premium	Poland, national	

					decrease together with increase in the considered area. 2005 to 2007				
23	Standardized questionnaire to obtain information on cuttings and silviculture, Binary logistic regression	profitability	mixed	PEFC	In Sweden, 37% of forest owners considered certification to affect profitability positively, 28% thought it had no noticeable effect, 27% had no opinion, and 5% considered any effect to be negative. small scale forest owner survey 1999–2006	[73]	Not specified	--	Sweden, national
24	Interviews with forest authorities, questionnaires	price premiums, cost-benefit	positive	FSC, PEFC	FSC and PEFC certification did not bring significant economic benefits to forest owners. However, forest owners gained a better environmental image of timber and wood products in the international markets, enhancing the long-term market access for timber and wood products. Cost-efficient group certification arrangements allowed reducing the costs and served as the primary driver for forest owners to participate in certification	[74]	Not specified	Yes, in Sweden (about EUR 1/m3) and Norway (about EUR 0.85m3), No in Finnland	Finland, Sweden, Norway
25	Mail questionnaire survey	price premiums, economic viability of forest operations	positive	FSC, PEFC	In Slovakia, 74% of forest owners received a price premium for certified wood in the range of 1-5%; nine percent received price premiums of 6–10%; and 12.7% did not receive a premium. Questionnaire conducted in 2017	[75]	Not specified	0-10%	Slovakia, national
26	Survey	direct and indirect cost	mixed	FSC	Over the final two years, three of the 14 CFs achieved a	[76]	Not specified	---	Italy

					minimal level of economic viability in the sense i.e. revenues were greater than the forest management costs yet revenues were still less than the total costs					
27	Focus group discussions, Survey (perceptions)	revenues and sales	mixed	FSC	More than half (58%) of the respondents in Romania indicated that the revenues did not increase after certification. At the same time, 42% considered that the FSC certification positively influenced the revenues.	[77]	Not specified	---	Romania, National	
28	Focus group discussions, Survey	price premiums	negative	FSC, PEFC (SFI)	In Minnesota, no price premiums could be gained in 2005.	[78]	Not specified	No premium	USA, Minnesota	
29	Mail survey	cost-benefits	negative	FSC	This study reported a negative relationship between costs and benefits.	[79]	Not specified	---	North America	
30	Event study methodology, analysis of short and the long-run stock price performance.	revenues and sales	mixed	FS+K3: K12C, PEFC (SFI/ CSA)	Our results suggest that forest certification has, on average, a negative impact on firm financial performance (FP). - The market has not recognized the benefits of forest certification. As a result, the expected benefits of certification relative to its associated costs have not been realized. - Our evidence also suggests that NGOs-led certification (FSC) has a neutral impact on FP, whereas industry-led certification (SFI, CSA, ISO14001) has a negative impact on FP. In other words, the nature or identity	[80]	Not specified	---	Canada, USA	North America

					of the certification program can offset the negative impact of certification on FP. 1998 to 2005				
31	Interviews with knowledgeable leaders of 100% of certified CBF initiatives in Vermont and about a third as many uncertified CBF initiatives to provide a comparative perspective (perceptions)	Price premiums, economic benefits/financial return	mixed	FSC	In Virginia, premiums were occasionally realized, but no value was reported. Group certificates and external funding significantly reduced certification costs.	[81]	Not specified	Occasionally realized	USA, Virginia
32	Cost-benefit analysis	price premiums, cost-benefit	positive	FSC	In North America, only one out of three studies reported that price premiums were gained, with certified wood products receiving a price premium of 10.5% and certified stumpage premiums between 1.6-4.3%. Price premiums for finished wood products were much higher for domestic sales than for export sales, with a price premium of 30% for domestic markets compared to premium for exported wood products of 3.4%. Direct and indirect costs and benefits calculated for The Forestland Group, an inde-pendent Timberland Investment Management Organization, found forest certification to be a net-positive program, earning an estimated $771,000 of additional	[82]	Natural	1.6-4.3% for certified stumpage	USA (forest land group)

					annual net revenue, about $0.24 per acre per year ($0.10 ha-1 yr-1)					
33	E-Mail questionnaires	price premiums, cost-benefit	negative	FSC	Fifty-eight percent of companies(n=17) identified that there were additional costs associated with IPM due to FSC forest certification, but they shared few details or estimates of these costs. A total of 44.8 % (n = 13) indicated satisfaction with the cost/benefit of the FSC with regard to Integrated pest management, while 34.5 % (n = 10) said they were unsure. On the other hand, 13.8 % (n = 4) reported that they were unsatisfied. increased market share or premium prices for wood and wood products have not yet been achieved. 2013	[83]	Plantations	---	Brazil, national (companies in the country)	South America
34	Survey questionaire, statical analysis, exploratory factor analysis (EFA)	price premiums	negative	FSC, PEFC (CERFLOR)	Companies do not see any return in terms of a better price for certified products (no price premium was gained); however, certificate holders indicated overall high satisfaction with market access. Higher performance was found for non-economic benefits. 2006	[84]	Plantations (39) natural (9)	No premium	Brazil, country	
35	Semi-structured stakeholder interviews, on-site visits to forestry operations	price premiums	negative	FSC	The additional costs incurred by certified forest production are therefore likely to be slightly greater in Ecuador than Bolivia, where forestry laws	[85]	Plantations forests (Equador) Natural	No premium	Ecuador, Bolivia, national	

					have been explicitly designed to be compatible with FSC certification. 2005 (jan to april)		forest (Bolivia)		
36	Field work, interviews, data analysis	price premiums	negative	FSC		[86]	Natural forest	No premium	Bolivia, national
37	Interview questionnaire, statistical analysis (perceptions	price premiums, cost-benefit	positive	PEFC (CERFLOR)	Benefits generally outweigh the costs. Companies appeared to consider certification a worthwhile venture, generating a satisfactory impact on the organizations' profitability. No price premiums but improved market access	[87]	Plantations (n = 39) Eucalyptus; natural forests (n = 9).	No premium	Brazil, national
38	Interviews, analysis of auditing reports (CARs)	price premiums, cost-benefit	positive	FSC, PEFC (CERFOR)	Economically, there were increased costs associated with certification. - Access gained or sustained by plantation forestry businesses to international markets seemed to counteract any increase in their costs. - Some large native forestry businesses did not benefit from better market access. Overall, in operational terms, certification yielded the most significant impacts in Plantation Forestry Business, particularly in large corporations. no Chilean company reported premium prices for selling certified timber (mainly pulpwood). Increased costs due to certification, was particularly felt by large PFBs	[88]	Plantation (mix of eucalyptus) and natural	No premium	Chile, southern regions

39	Structured interviews, review of documents, including reports, articles, and presentations related to the operations	price premiums,	positive	FSC	Positive perceptions of receiving market benefits, product distinction, better prices, access to new markets	[89]	Not specified	Yes,but unspelled.	Brazil, Acre
40	Personal interviews, email surveys with forestry organizations to collect cost and benefit information/data in 2006 and 2007	cost-benefits	mixed	FSC, PEFC (SFI, CERFLOR, CERTFOR)	Large variation of the average costs of forest certification per ha (range from almost no costs to $57.29 per ha/per year for organization with the greatest costs). - Average total costs for certification were a function of ownership size, but did not vary significantly among certification systems or country, although the sample of reporting firms was small for finding statistical differences. - Average cost decreased dramatically for ownership sizes more than 4000 ha. - Forest certification costs appeared to be higher for South America compared to North America.	[90]	Plantations and natural	--	Argentina, Brazil, the United States and Canada, and Chile
41	Statistical analysis, linear regression, scenarios, household survey	household income	positive	FSC	Positive effects on household income. Effects differ among communities depending on their socio-economic characteristics. Incomes among individuals engaged in concession activity in nonresidential concessions were around 7600 quetzals (about $1,000) per year higher.	[91]	Not specified	--	Guatemala, Maya Biosphere Reserve

					The financial benefits of FSC tend to outweigh the costs, albeit with high company-by-company variance and special consideration required for high conservation value (HCV) set-asides and intangible benefits. On average, the companies earned an extra US$1.80 for every cubic meter of FSC- certified Roundwood or equivalent, over and above any new costs, due to price premiums, increased efficiency, and other financial incentives.				
42	Calculation of net present value/profitability	cost-benefits	positive	FSC	• The business case was most vital for tropical forest operations and small/medium producers (regardless of geography) who experienced significant financial gains, while temperate and large producers experienced small losses. • It took the companies, on average, six years to break even on their FSC investment. • The average annual benefit of FSC was US$6.03 per m3 of certified production – US$1.80 higher than the average cost. • Positioning for market premiums and optimizing operational improvements from FSC can add the most value to the firm.	[92]	Plantation and natural	--	Colombia, Peru, Cameroon, Portugal (2), Indonesia, Malaysia (2), Russia (3)

4. Desktop studies

Table S6. Desktop studies deforestation.

Deforestation					
No	**Objective**	**Method**	**Scheme**	**World region**	**Reference**
1	This study draws on a case study of the Brazilian Amazon to assess how two widely promoted strategies to govern tropical forests – non-state certification and state-based legality initiatives – interact with tropical wood production systems and the implications this holds for reducing deforestation and degradation and for local benefit-sharing.	Case study research	FSC, PEFC-CERFLOR	Brazil, Amazon	McDermott, Constance L.; Irland, Lloyd C.; Pacheco, Pablo (2015): Forest certification and legality initiatives in the Brazilian Amazon: Lessons for effective and equitable forest governance. In: Forest Policy and Economics 50, S. 134–142. DOI: 10.1016/j.forpol.2014.05.011.
2	This study reviews what we know about forest certification's effectiveness and broader consequences. A narrow definition of effectiveness judges forest certification as effective if it contributes directly to resolving the problem it was created to address. We can then conceive the effectiveness of forest certification as the degree to which this instrument modifies on-the-ground practices in ways that are likely to reverse or alleviate environmental deterioration and socio-economic harm resulting from the forest.	Literature review	General FC	Worldwide/General	Auld, Graeme; Gulbrandsen, Lars H.; McDermott, Constance L. (2008): Certification Schemes and the Impacts on Forests and Forestry. In: Annu. Rev. Environ. Resour. 33 (1), S. 187–211. DOI: 10.1146/annurev.environ.33.013007.103754.
3	In this article, we review the current global forest cover and condition information, examine the international processes related to forest protection and sustainable forest management, and look at the main forest certification schemes. It considers the link between the international processes and certification schemes and their combined effectiveness.	Literature review	General FC	Worldwide/General	Freer-Smith, Peter; Carnus, Jean-Michel (2008): The Sustainable Management and Protection of Forests: Analysis of the Current Position Globally. In: AMBIO: A Journal of the Human Environment 37 (4), S. 254–262. DOI: 10.1579/0044-7447(2008)37[254:TSMAPO]2.0.CO;2.
4	The study looks at the prospects and limits of this shift toward eco-consumerism as a mechanism for global change and analyzes its value for improving forest management globally.	Literature review	General FC	Worldwide/General	Dauvergne, Peter; Lister, Jane (2010): The Prospects and Limits of Eco-Consumerism: Shopping Our Way to Less Deforestation? In: Organization & Environment 23 (2), S. 132–154. DOI:

					10.1177/1086026610368370.
5	This study assesses the following issues. First, is forest harvesting related to deforestation? Second, are timber products a by-product of deforestation? Third, do countries with more important forest sectors experience more deforestation than others? Fourth, does timber certification play a key role in favoring sustainable harvesting?	Panel data analysis/econometric model	General FC	World-wide/General	Damette, Olivier; Delacote, Philippe (2011): Unsustainable timber harvesting, deforestation and the role of certification. In: Ecological Economics 70 (6), S. 1211–1219. DOI: 10.1016/j.ecolecon.2011.01.025.
6	This study explores the political dynamics of these new governance initiatives by presenting an in-depth case study of the Forest Stewardship Council (FSC), often regarded as a model for the multi-stakeholder initiative.	Neo-Gramscian analysis to the organizational evolution of the FSC	FSC	World-wide/General	Moog, Sandra; Spicer, André; Böhm, Steffen (2015): The Politics of Multi-Stakeholder Initiatives: The Crisis of the Forest Stewardship Council. In: J Bus Ethics 128 (3), S. 469–493. DOI: 10.1007/s10551-013-2033-3.
7	This article examines the macro-effectiveness of certification on halting deforestation and examines the relationship between certification and governance institutions.	Calculations based on FAO statistical database, Literature review	FSC	World-wide/General	Marx, Axel; Cuypers, Dieter (2011): Halting Deforestation and Forest Certification – What is the Macro-Impact of the Forest Stewardship Council? In: SSRN Journal. DOI: 10.2139/ssrn.1763401.

Table S7. Macro economic studies and scenarios on deforestation.

Deforestation: Macro-economic/Scenarios					
No.	**Objective**	**Method**	**Scheme**	**World region**	**Reference**
1	This study aims to better understand how the global financial crisis (GFC) impacted sustainable forest management (SFM) (and as part of its forest certification) in Brazil through the experiences and perceptions of highly knowledgeable stakeholders.	Grounded theory, case study, semi-structured interviews	FSC, PEFC-CERFLOR	Brazil	Canova, Natalia (2011): Understanding the impacts of the 2007-08 global financial crisis on Brazil´s forest sector- A qualitative study. Master thesis.
2	This paper aims to map the international regime complex for rainforest transformation by identifying those global and regional regimes relevant to tropical rainforest transformation systems in Indonesia.	Content analysis of international policy documents and treaty texts, expert interviews with key informants in Indonesia,	FSC, PEFC	Indonesia	Sahide, Muhammad Alif K.; Nurrochmat, Dodik Ridho; Giessen, Lukas (2015): The regime complex for tropical rainforest transformation: Analyzing the relevance of

		field observations in current Indonesian land use politics (conducted by author)			multiple global and regional land use regimes in Indonesia. In: Land Use Policy 47, S. 408–425. DOI: 10.1016/j.landusepol.2015.04.030.
3	This article examines the macro-effectiveness of certification on halting deforestation and examines the relationship between certification and governance institutions. The article assesses the degree to which certification contributes to halting deforestation, a key component of SFM, by analyzing the differences in uptake of FSC certification between countries.	Analysis of datasets	FSC	World-wide/General	Marx, Axel; Cuypers, Dieter (2010): Forest certification as a global environmental governance tool: What is the macro-effectiveness of the Forest Stewardship Council? In: Regulation & Governance 4 (4), S. 408–434. DOI: 10.1111/j.1748-5991.2010.01088.x.
4	The analysis aims to identify the possible determinants of EU imports of timber and timber products from non-EU countries in recent years, following the implementation of the EUTR.	Gravity model; panel data model (estimated with 228 observations from 38 exporting countries between 2012 and 2017)	FSC, PEFC	World-wide/General	Moral-Pajares, Encarnación; Martínez-Alcalá, Concepción; Gallego-Valero, Leticia; Caviedes-Conde, Ángela Andrea (2020): Transparency Index of the Supplying Countries' Institutions and Tree Cover Loss: Determining Factors of EU Timber Imports? In: Forests 11 (9), S. 1009. DOI: 10.3390/f11091009.
5	This study examines the impacts of trade and policies on forest stock.	General equilibrium model	General FC	World-wide/General	Jinji, Naoto (2006): International trade and terrestrial open-access renewable resources in a small open economy. In: Canadian Journal of Economics (39 (3)).

Table S8. Desktop studies Forest degradation.

Forest Degradation: Desktop					
No.	**Objective**	**Method**	**Scheme**	**World region**	**Reference**
1	The study discusses barriers to biodiversity conservation in forest certification.	Literature review	General FC	World-wide/General	Ghazoul, Jaboury (2001): Barriers to Biodiversity Conservation in Forest Certification. In: Conservation Biology (15 (2)), S. 315–317.
2	This study examines the role and contribution of forest certification as a	Literature review	FSC	World-wide/General	Gullison, R. E. (2003): Does forest certification

	biodiversity conservation tool, focusing in particular on the only global certification system, the Forest Stewardship Council (FSC).				conserve biodiversity? In: Oryx 37 (2), S. 153–165. DOI: 10.1017/S0030605303000346.
3	This study assesses which role forest certification can play as an instrument to promote sustainable forest management (SFM) and biodiversity maintenance, how far the main concepts have been developed, and what lessons we can learn after ten years of implementation. The paper focuses on progress in developing forest certification and defining what forest certification sets out to verify sustainable forest management.	Literature review	General FC	World-wide/General	Rametsteiner, Ewald; Simula, Markku (2003): Forest certification—an instrument to promote sustainable forest management? In: Journal of Environmental Management 67 (1), S. 87–98. DOI: 10.1016/S0301-4797(02)00191-3.
4	This study analyzes the forest certification process in Guatemala, focusing on the forest concessions in the Maya Biosphere Reserve (MBR), where 95 percent of the certified forest area in Guatemala is located.	Case study	FSC	Guatemala, Maya Biosphere Reserve	Carrera, Fernando; Stoian, Dietmar; Joaquin Campos Arce, Jose; Israel Pinelo, Gustavo (2006): Forest certification in Guatemala.
5	This study proposes that carbon markets, through RIL, can act as a vehicle to rise in the Hierarchy of Production Forest Management towards achieving SFM in the tropics.	Literature review	FSC	Tropical regions	Wintle, B. A.; Lindenmayer, D. B. (2008): Adaptive risk management for certifiably sustainable forestry. In: Forest Ecology and Management 256 (6), S. 1311–1319. DOI: 10.1016/j.foreco.2008.06.042.
6	This study synthesizes the published information about how forest certification and community forest management perform in environmental, social, and economic variables.	Systematic literature review	FSC	Tropical regions	Burivalova, Zuzana; Hua, Fangyuan; Koh, Lian Pin; Garcia, Claude; Putz, Francis (2017): A Critical Comparison of Conventional, Certified, and Community Management of Tropical Forests for Timber in Terms of Environmental, Economic, and Social Variables. In: CONSERVATION LETTERS 10 (1), S. 4–14. DOI: 10.1111/conl.12244.
7	This study evaluates the literature for four mainstream strategies (forest certification and reduced impact logging,	Literature review on the effectiveness of four	FSC	Tropical regions	Burivalova, Zuzana; Allnutt, Thomas F.; Rademacher, Dan; Schlemm,

	payments for ecosystem services, protected areas, community forest management) in terms of 35 environmental, social, and economic metrics. We evaluated whether applying the strategy improved, left unchanged, or worsened the conservation metrics, and we created an interactive platform to view the data.	mainstream conservation strategies: (a) FSC-RIL; (b) PES; (c) strictly PAs (IUCN category I, II, and III); and (d) CFM (including, but not restricted to areas designated as IUCN categories V and VI).			Annika; Wilcove, David S.; Butler, Rhett A. (2019): What works in tropical forest conservation, and what does not: Effectiveness of four strategies in terms of environmental, social, and economic outcomes. In: Conservat Sci and Prac 1 (6), e28. DOI: 10.1111/csp2.28.
8	This study identifies several actions that could improve the weakened situation of fire-dependent biodiversity (as caused by my standards of forest certification).	Desktop study	PEFC	Finland	Lindberg, Henrik; Punttila, Pekka; Vanha-Majamaa, Ilkka (2020): The challenge of combining variable retention and prescribed burning in Finland. In: Ecol Process 9 (1). DOI: 10.1186/s13717-019-0207-3.
9	This study conducted a systematic review of the ecological literature associated with planted Pinus and Eucalyptus species in Brazil. It compares publication metrics with the geographical distribution of species, ecosystems, biomes studied taxa, and ecological impacts.	Systematic review	FSC	Brazil	Valduga, Marcos O.; Zenni, Rafael D.; Vitule, Jean R. S. (2016): Ecological impacts of non-native tree species plantations are broad and heterogeneous: a review of Brazilian research. In: Anais da Academia Brasileira de Ciencias 88 (3 Suppl), S. 1675–1688. DOI: 10.1590/0001-3765201620150575.
10	This work examines the effectiveness of forest certification and how the aims mentioned previously have been achieved.	Literature review (method not specified in text)	General	World-wide/General	Cerda, Aldo; Lira, Valentina (2002): THE ECONOMICS OF SUSTAINABLE FOREST MANAGEMENT CERTIFICATION. PAPER PRESENTED TO SECOND WORLD CONGRESS OF ENVIRONMENTAL AND RESOURCE ECONOMISTS.
11	We provide an overview of studies that evaluate FSC certification and associated benefits for forest biodiversity conservation. We include studies with response variables that are known to be	Literature review on studies of impact evaluation studies, data about FSC certification	FSC	World-wide/General	Nicholas R. Brown, Reed F. Noss, David D. Diamond, and Mariah N. Myers (2001): Conservation biology and forest

	directly (animal and plant diversity) and indirectly (deforestation, forest degradation) related to forest biodiversity conservation.	and associated outcomes, incl. field studies providing on- the-ground data. Analysis of Corrective Action Requests (CARs).			certification. Working Together toward Ecological Sustainability. In: Journal of Forestry.
12	This book chapter provides an overview of studies that evaluate FSC certification and associated benefits for forest biodiversity conservation. We include studies with response variables that are known to be directly (animal and plant diversity) or indirectly (deforestation, forest degradation) related to forest biodiversity conservation.	Literature review	FSC	Worldwide/General	Franck Trolliet, Melissa Vogt, Franck Trolliet (Hg.) (2019): How does FSC certification of forest management benefit conservation of biodiversity? Sustainability Certification Schemes in the Agricultural and Natural Resource Sectors: Routledge.
13	This report aims to fill this knowledge gap by presenting the results of a 'qualitative literature review' (QLR) of existing research, on the direct environmental impacts of FSC and PEFC, in the boreal, temperate, and tropical biomes.	Literature review	FSC, PEFC	Worldwide (boreal, temperate, and tropical biomes)	Di Girolami, Erica; Arts, Bas (2018): Environmental impacts of Forest Certifications. Qualitative Literature Review of Scientific Research on the Environmental Impacts of the Forest Stewardship Council (FSC) Certification Scheme and the Programme for the Endorsement of Forest Certification (PEFC) in the Boreal, Temperate and Tropical Biomes.
14	A literature study was conducted to assess the scientific evidence for the effect of certified forest management on biodiversity in tropical, temperate, and boreal forests. This study focuses on studies that compared certified with 'conventional' forestry practices within the wealth of literature discussing the impact of logging on plants and animals.	Literature review	General FC	Worldwide (tropical, temperate and boreal forests)	van Kuijk, Marijke; Putz, Francis E.; Zagt, Roderick (2009): Effects of forest certification on biodiversity. Wageningen, The Netherlands.

Table S9. Models and Scenarios Forest degradation**.**

Forest Degradation: Models & Scenarios					
No.	**Objective**	**Method**	**Scheme**	**World region**	**Reference**
1	The effects of hydrological processes on landscape-level measures included in the sustainable forestry initiative (SFI)	Landscape modeling; HARVEST landscape model	PEFC-SFI	USA, Texas	Azevedo, JoÃo C.; Williams, Jimmy R.; Messina, Michael G.; Fisher,

	program were analyzed through simulation.	was used to simulate landscape pattern and a modified version of the APEX model was used to simulate hydrological processes.			Richard F. (2005): Impacts of the Sustainable Forestry Initiative Landscape Level Measures on Hydrological Processes. In: Water Resour Manage 19 (2), S. 95–110. DOI: 10.1007/s11269-005-1503-5.
2	The study developed a methodology to analyze the effects of management practices on landscape structure and function to assess sustainability in intensively managed forest landscapes.	Landscape modeling; HARVEST landscape model was used to simulate landscape pattern and a modified version of the APEX model was used to simulate hydrological processes.	PEFC-SFI	USA, Texas	Joa˜o C. Azevedo, X. Ben Wu, Michael G. Messina, and Richard F. Fisher (2005): Assessment of Sustainability in Intensively Managed Forested Landscapes: A Case Study in Eastern Texas. In: Forest Science.
3	The study modeled carbon and biodiversity outcomes for four archetypal timber production systems that deliver the same timber volume but vary in spatial extent and harvest intensity. We include impacts of variable deforestation risk (secure land tenure or not) and alternative harvesting practices (certified an uncertified).	Scenario modelling	FSC	Tropical regions	Griscom, Bronson W.; Goodman, Rosa C.; Burivalova, Zuzana; Putz, Francis E. (2018): Carbon and Biodiversity Impacts of Intensive Versus Extensive Tropical Forestry. In: CONSERVATION LETTERS 11 (1), e12362. DOI: 10.1111/conl.12362.

Table S10. Desktop studies economic viability.

Economic viability: Desktop					
No.	**Objective**	**Method**	**Scheme**	**World region**	**Reference**
1	This study reviews how the different countries of the Americas carried out the forest certification process by the FSC system and discusses how external factors would have influenced these processes.	Documentary research; literature review, data of (certified) forest areas	FSC	South and North America	Basso, V. M.; Jacovine, L.A.G.; Nardelli, A.M.B.; Alves, R. R.; Silva, E. V.; Silva, M. L.; Andrade, B. G. (2018): FSC forest management certification in the Americas. In: int. forest. rev. 20 (1), S. 31–42. DOI: 10.1505/146554818822824219.
2	This study evaluates four mainstream strategies (forest certification and reduced impact logging, payments for ecosystem services, protected areas,	Systematic literature review	FSC	Tropical forest countries	Burivalova, Zuzana; Allnutt, Thomas F.; Rademacher, Dan; Schlemm, Annika; Wilcove, David

	community forest management) in terms of 35 environmental, social, and economic metrics. We evaluated whether applying the strategy improved, left unchanged, or worsened the conservation metrics, and we created an interactive platform to view the data.				S.; Butler, Rhett A. (2019): What works in tropical forest conservation, and what does not: Effectiveness of four strategies in terms of environmental, social, and economic outcomes. In: Conservat Sci and Prac 1 (6), e28. DOI: 10.1111/csp2.28.
3	A qualitative meta-synthesis approach is applied to this body of evidence to assess producer benefits reported in case studies of Forest Stewardship Council (FSC) and Marine Stewardship Council (MSC) certification in developing countries.	Literature review/meta-analysis	FSC	Developing countries	Carlson, Anna; Palmer, Charles (2016): A qualitative meta-synthesis of the benefits of eco-labeling in developing countries. In: Ecological Economics 127, S. 129–145. DOI: 10.1016/j.ecolecon.2016.03.020.
4	This study analyzes the forest certification process in Guatemala, focusing on the forest concessions in the Maya Biosphere Reserve (MBR), where 95 percent of the certified forest area in Guatemala is located.	Case study	FSC	Guatemala, Maya Biosphere Reserve	Carrera, Fernando; Stoian, Dietmar; Joaquin Campos Arce, Jose; Israel Pinelo, Gustavo (2006): Forest certification in Guatemala.
5	This study answers why the momentum behind forest certification has been so weak in developing countries.	Literature review	FSC, PEFC (CERFLOR; SFI, CSA stc).	Developing countries	Cashore, Benjamin; Gale, Fred; Meidinger, Errol; Newsom, Deanna (2006): Forest Certification in Developing and Transitioning Countries: Part of a Sustainable Future? In: Environment: Science and Policy for Sustainable Development 48 (9), S. 6–25. DOI: 10.3200/ENVT.48.9.6-25.
6	This study identifies and analyzes the main factors influencing the diffusion of the Forest Stewardship Council (FSC) smallholder certification in Europe. Furthermore, potential strategies to help FSC meet the requirement of smallholders—and, consequently, enhance their access to certification—are pointed out.	Review of FSC certification reports, SWOT-ANP analysis	FSC	Europe	Di Lallo, Giulio; Maesano, Mauro; Masiero, Mauro; Mugnozza, Giuseppe Scarascia; Marchetti, Marco (2016): Analyzing Strategies to Enhance Small and Low Intensity Managed Forests Certification in Europe using SWOT-ANP. In: Small-scale Forestry 15 (3), S. 393–411. DOI: 10.1007/s11842-016-9329-y.

7	This study evaluates the challenges facing certification and eco-labeling forest products in developing countries.	Documentary research; literature review, data of (certified) forest areas	FSC, PEFC (CERFLOR; SFI, CSA stc).	Developing countries	Durst, P.B; McKenzie, P.J; Brown, C.L; Appanah, S. (2006): Challenges facing certification and eco-labelling of forest products in developing countries. In: International Forestry Review 8 (2), S. 193–200. DOI: 10.1505/ifor.8.2.193.
8	This study aims to determine the current and historical general trends of FSC certification in the tropics and to provide insights into the nature of problematic management issues and how these issues have evolved across different regions.	Data analysis, literature review	FSC, PEFC	Tropical forest countries	Ehrenberg-Azcárate, Francisco; Peña-Claros, Marielos (2020): Twenty years of forest management certification in the tropics: Major trends through time and among continents. In: Forest Policy and Economics 111, S. 102050. DOI: 10.1016/j.forpol.2019.102050.
9	This study assesses the roles and contributions of smallholder tree-farmers in and across regional supply chains and the regulatory compliance, voluntary verification, and market access environments in which they operate.	Literature review	General FC	South East Asia/Vietnam as case study (Thien Hue)	Flanagan, A. C.; Midgley, S. J.; Stevens, P. R.; McWhirter, L. (2019): Smallholder tree-farmers and forest certification in Southeast Asia: productivity, risks and policies. In: Australian Forestry 82 (1), S. 18–28. DOI: 10.1080/00049158.2018.1560569.
10	This study reviews the economic issues and potential welfare implications of forest certification in light of this management goal but finds that the effect of certification on forest product markets is uncertain. It examines why certification schemes may fail to regulate optimally market failures and decrease welfare compared to a non-certified state.	Macro empirical study, statistical analysis to evaluate the key market and socio-political drivers of Forest Stewardship Council certification uptake and growth	FSC, PEFC (CSA, SFI)	Worldwide	Jarus, Val: Forest Certification: Economic Issues and Welfare Implications. In: CANADIAN PUBLIC POLICY 1998.
11	Building on available data, the probable contributions of smallholder assets to national economies and smallholder livelihoods are calculated for acacias in Vietnam and eucalypts in Guangxi Province, China, and smallholder contributions to commercial wood flow in several other Asian countries.	Desktop/review of Literature	General FC	China, Guangxi Province	Midgley, S. J.; Stevens, P. R.; Arnold, R. J. (2017): Hidden assets: Asia's smallholder wood resources and their contribution to supply chains of commercial wood. In: Australian Forestry 80 (1), S. 10–25. DOI:

					10.1080/00049158.2017.1280750.
12	Based on available literature, this study discusses the question: have the conservation-focused and pro-poor forestry research and policies, and the related advocacies of NTFPs, PES, and REDD+ enabled rural developments improved livelihoods for combatting poverty? It is analyzed how forestry could play a more active and contributing role in the development sector.	Literature review	FSC, PEFC (CSA, SFI, ATFS)	Tropical regions	Nambiar, E. Sadanandan K. (2019): Tamm Review: Re-imagining forestry and wood business: pathways to rural development, poverty alleviation and climate change mitigation in the tropics. In: Forest Ecology and Management 448, S. 160–173. DOI: 10.1016/j.foreco.2019.06.014.
13	This study assesses the status and problems in the certification of Sustainable Forest Management in China.	Data analysis, literature review	FSC	China	Zhao, Jingzhu; Xie, Dongming; Wang, Danyin; Deng, Hongbing (2011): Current status and problems in certification of sustainable forest management in China. In: Environmental management 48 (6), S. 1086–1094. DOI: 10.1007/s00267-011-9620-9.
14	This study analyses the reasons for the success of YFOC (one most successful example of FSC certification holders in the country because of their strong economic performance after gaining certification in 2000.) in terms of their forestry, sawmill activities, and timber marketing.	Literature review	FSC	Japan	Ota, Ikou (2006): Experiences of a Forest Owners' Cooperative in using FSC Forest Certification as an Environmental Strategy. In: Small-scale Forest Economics, Management and Policy, S. 111–126.
15	This study synthesizes the published information about how forest certification and community-forest management perform in environmental, social, and economic variables.	Systematic review; qualitative synthesis of the existing literature	FSC	Tropical forest countries	Burivalova, Zuzana; Hua, Fangyuan; Koh, Lian Pin; Garcia, Claude; Putz, Francis (2017): A Critical Comparison of Conventional, Certified, and Community Management of Tropical Forests for Timber in Terms of Environmental, Economic, and Social Variables. In: CONSERVATION LETTERS 10 (1), S. 4–14. DOI: 10.1111/conl.12244.

16	This paper discusses the effects of these eco-labels programs on developing countries' market access. It explains how the multitude and the complexity of eco-labeling programs could become a non-tariff trade barrier.	Literature review	General FC	Developing countries	Violeta BAJENARU-DE-CLERCK (Hg.) (2008): The forest certification and eco-labels: a social progress or new non-tariff barriers? Proceedings of the 51st International Convention of Society of Wood Science and Technology. Concepción, Chile, 10-12 November.
17	This study explored the opportunity costs of restricting silvicultural options by comparing natural pine regimes to plantation management regimes with and without herbicide using basic economic criteria.	Economic analysis, discounting of Net Present Value and Land expectation value	FSC, PEFC-SFI, CSA	Worldwide	van Deusen, P. C.; Wigley, T. B.; Lucier, A. A. (2010): Some indirect costs of forest certification. In: Forestry 83 (4), S. 389–394. DOI: 10.1093/forestry/cpq021.
18	This study studies the conditions imposed on forest operators for getting certified and the export prices of certified vs. non-certified timber products. In addition, the study provides a basis for assessing aspects of certification's effectiveness, efficiency, and equity.	Literature review, document analysis	FSC	Bolivia	Nebel, Gustav; Quevedo, Lincoln; Bredahl Jacobsen, Jette; Helles, Finn (2005): Development and economic significance of forest certification: the case of FSC in Bolivia. In: Forest Policy and Economics 7 (2), S. 175–186. DOI: 10.1016/S1389-9341(03)00030-3.

Table S11. Macro-economic studies economic viability/economic impact**.**

Economic viability: Macro-economic					
No.	**Objective**	**Method**	**Scheme**	**World region**	**Reference**
1	This study estimates the market and economic impacts of the American Forests and Paper Association's Sustainable Forestry Initiative (SFI) on stumpage markets in the US South. We examine four timber product markets: softwood pulpwood, softwood sawtimber, hardwood pulpwood, and hardwood sawtimber.	Survey data; equilibrium displacement model	PEFC-SFI	USA, South	Brown, Roger; Zhang, Daowei (2005): The Sustainable Forestry Initiatives impact on stumpage markets in the US South. In: Can. J. For. Res. 35 (8), S. 2056–2064. DOI: 10.1139/x05-135.
2	This study assesses the impacts of forest certification costs on the output, price, and trade of forest products via computable general equilibrium modeling under various scenarios representing tropical, temperate, and global forest certification.	General equilibrium analysis (GTAP), scenario analysis	FSC, PEFC-CERFLOR	Worldwide	Gan, Jianbang (2005): Forest certification costs and global forest product markets and trade: a general equilibrium analysis. In: Can. J. For.

					Res. 35 (7), S. 1731–1743. DOI: 10.1139/x05-100.
3	Using a complex dynamic forest optimization model, we analyze the impacts on the economy and biodiversity of forest management restrictions implemented to protect biodiversity (i.e., forest certification).	Complex dynamic forest optimization model	PEFC	Norway	Bergseng, Ev en; Ask, Jon Andreas; Framstad, Erik; Gobakken, Terje; Solberg, Birger; Hoen, Hans Fredrik (2012): Biodiversity protection and economics in long term boreal forest management — A detailed case for the valuation of protection measures. In: Forest Policy and Economics 15, S. 12–21. DOI: 10.1016/j.forpol.2011.11.002.
4	This research estimates the productivity and economic implications of a scenario resembling the management of nonindustrial private forestland. The research compares estimates from a mechanical-only treatment and two levels of chemical treatments between certification schemes.	Scenario analysis	FSC		Mendell, Brooks C.; Lang, Amanda H.; Caldwell, Will; Garrett, David L. (2015): Chemical Use and Forest Certification: Productivity and Economic Implications. In: Journal of Forestry 113 (4), S. 367–371. DOI: 10.5849/jof.14-121.
5	This paper analyzes the restricting effect of forest certification on the trade of wood products under the decline of tariff barriers.	Partial equilibrium modeling/space price gradient field model	FSC, PEFC	Worldwide	Guan, Zhijie; Ip Ping Sheong, Jim Kwee Fat (2019): The Restricting Effects of Forest Certification on the International Trade of Wood Products. In: Journal of Sustainable Forestry 38 (8), S. 809–826. DOI: 10.1080/10549811.2019.1607756.
6	This study evaluates the influence of forest certification on international trade. Furthermore, it provides a scientific basis for improving the international forest certification systems and the development of relevant forestry industries in different countries.	Gravity model	FSC, PEFC	Worldwide	Chen, Jiaojiao; Wang, Lanhui; Li, Lingchao; Magalhães, Juliana; Song, Weiming; Lu, Wenming et al. (2020): Effect of Forest Certification on International Trade in Forest Products. In: Forests 11 (12), S. 1270. DOI: 10.3390/f11121270.

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