INTERNATIONAL TROPICAL TIMBER ORGANIZATION

ITTO

PROJECT DOCUMENT

TITLE:	DEVELOPMENT AND IMPLEMENTATION OF A SPECIES IDENTIFICATION AND TIMBER TRACKING SYSTEM IN AFRICA WITH DNA FINGERPRINTS AND STABLE ISOTOPES
SERIAL NUMBER:	PD 620/11 **Rev.1** (M)
COMMITTEE:	ECONOMIC INFORMATION AND MARKET INTELLIGENCE
SUBMITTED BY:	GOVERNMENT OF GERMANY
ORIGINAL LANGUAGE:	ENGLISH

SUMMARY:
Illegal logging and associated trade are the cause of many economic and ecological problems both in timber producer and timber consumer countries. Although many legal instruments (EU timber trade regulation, US Lacey Act etc.) have been established to combat illegal logging and trade of illegally sourced timber, practical controls mechanisms to identify the tree species and geographic origin of wood and wood products are still lacking. DNA fingerprints and stables isotopes techniques use characters inherent to the timber (impossible to falsify) and the combination of both methods guarantee a high spatial resolution and a strong statistical power at higher cost efficiency for the control of origin of wood and wood products. We propose to develop a three years regional project on species identification and timber tracking system with DNA fingerprints and stable isotopes for several important timber tree species in the following African countries: Cameroon, Central African Republic, Congo Dem. Rep, Congo Rep., Gabon, Ghana and Kenya. During a seven month phase of the ITTO pre-project "TFL-PPD 023/10" the work-programme, the contribution and participation of the different partners from Europe, Australia and Africa as well as the stakeholder involvement have been worked out. The project will focus primarily on the three target species chosen by timber producing countries representatives: iroko (*Milicia excelsa, M. regia*), sapelli (*Entandrophragma cylindricum*) and ayou (*Triplochiton scleroxylon*). For these species we will sample over the distribution area of the species leaves or cambium and wood samples. We will develop gene markers that show a high genetic differentiation among trees of different locations and work also for processed timber. The samples will be screened for DNA fingerprints and stable isotopes and provide in this way a genetic and chemical reference data base to control the country of origin. Using DNA-fingerprints a tree by tree approach to control the chain of custody will be applied for Ayou and Sapelli in cooperation with the forestry commission and the Forest Research Institute and timber companies in Ghana and Cameroon. Tools to identify the species will be further developed using both a wood anatomical approach and the DNA barcoding for 20 important African timber species. The statistical power and practical performance of the different assignment approaches (species identity, country of origin and chain of custody of individual trees) will be checked by blind tests. As measures of capacity building and technology transfer three reference labs in West-Africa (Kumasi, Ghana), Central-Africa (Libreville, Gabon) and East-Africa (Nairobi, Kenya) will be established and staff of these labs but also from other African groups will be trained to apply DNA-techniques and wood anatomy to identify the tree species and to perform simple DNA tests to check the origin. The results of the project will be provided to the international coordination office for tree identification and origin assignment at Bioversity International in Malaysia. The Institute of Forest Genetics at the Johann Heinrich von Thünen Institute in Germany is the executive agency and coordinator of the project. During the project the executive agency will be supported by 14 collaborative agencies from Europe, Africa and Australia.

EXECUTING AGENCY	Johann Heinrich von Thünen Institute (vTI) Federal Research Institute for Rural Areas, Forestry and Fisheries
DURATION	36 months

BUDGET AND PROPOSED SOURCES OF FINANCE:	**Source**	**Contribution in US$**
	ITTO	1,695,342
	Executing Agency	220,932
	TOTAL	**1,916,274**

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PROJECT BRIEF

Illegal logging and associated trade are the cause of many economic and ecological problems both in timber producer and timber consumer countries. Although many legal instruments (forest laws in timber producing countries, EU FLEGT initiative, EU timber trade regulation, US Lacey Act etc.) have been established to combat illegal logging and trade of illegally sourced timber, practical control mechanisms to identify the origin of wood and wood products are still lacking. The test used currently to identify species and control their international trade (such as CITES), and existing timber tracking systems (using mostly paper-based documentation) have met their limits for many tropical tree species. A new technique with labeling of timber with secure bar-code tags uploaded automatically into Helveta's CI World online system is being tested in some places. But all of the techniques mentioned above use externally applied marks that can be manipulated along the chain of custody and don't eliminate the possibility of laundering timber from illegal sources.

DNA fingerprints and stables isotopes techniques used characters inherent to the timber (impossible to falsify) and the combination of both methods guarantee a high spatial resolution and a strong statistical power at higher cost efficiency for the control of origin of wood and wood products. It is also demonstrated today that by combining wood anatomical features and DNA barcode sequences of closely related or similar species sampled across the distribution range, it is possible to distinguish among them unambiguously.

Several years of pilots studies conducted of various tropical species have demonstrated the robustness and the credibility of the new methods on small scale. We propose therefore to develop a three years regional project on species identification and timber tracking system with DNA fingerprints and stable isotopes for several important timber tree species in the following African countries: Cameroon, Central African Republic, Congo Dem. Rep, Congo Rep., Gabon Ghana and Kenya.
Within the ITTO pre-project "TFL-PPD 023/10 " the contribution and participation of the African countries have been discussed intensively, particularly during a workshop in Yaoundé, Cameroon 22nd to 23rd of March 2011. The ITTO focal points of all six African ITTO members and the Forest Service and the Forest Research Institute of Kenya welcomed the project and provided through their representatives a supporting letter annexed to the project. The project will focus primarily on the following three target species chosen by timber producing countries representatives: iroko (*Milicia excelsa, M. regia*), sapele (*Entandrophragma cylindricum*) and ayou (*Triplochiton scleroxylon*).

For these species we will sample over the distribution area of the species within the seven participating countries leaves or cambium and wood samples from up to 20 trees in each of 50 to 100 locations per species. For the three species we will develop gene markers that show a high genetic differentiation among trees of different locations and work also for processed timber. Then the samples will be screened for DNA fingerprints and stable isotopes and provide in this way a genetic and chemical reference data base to control the country of origin.

Using DNA-fingerprints a tree by tree approach to check the chain of custody will be applied for Ayou and Sapelli in cooperation with timber companies in Ghana and Cameroon.

Moreover for 20 important timber species tools to identify the species will be further developed using a wood anatomical approach and the DNA barcoding. The statistical power and practical performance of the different assignment approaches (species identity, country of origin and chain of custody of individual trees) will be checked by blind tests.

The application of DNA markers to assign species and origin on processed timber assumes that the quality of extracted DNA is sufficient. To keep the risk of insufficient DNA quality as low as possible we will (a) put particular emphasis to further develop the DNA extraction protocols, and (b) work with DNA-markers that show genetic variation for short DNA fragments because these DNA markers are less sensitive to degraded DNA.

Assigning the geographic origin of timber assumes that the underlying spatial genetic pattern of DNA-markers and stable isotopes in the natural distribution area of the tree species is high strong enough. To be sure on that we will (a) develop a high number of DNA-markers for each of the three species using the new generation DNA sequencing approach and (b) make a combined application of DNA-markers + stable isotopes to assign the country of origin.

The sampling of the plant material for the three timber species to develop the reference data bases for origin assignment is a labor intensive and complicated work. It needs a good coordination between different teams

in different countries. The sampling teams need to be well trained. Thus we will follow a two step sampling approach with a first genetic and isotopic screening of 2/3 of all samples followed by a first data analysis and the remaining 1/3 sampling according to the first results and identified high priority sampling regions.

We have 5 different labs working on the generics and 3 labs working on the stable isotopes + 3 genetic reference labs to be established in Africa. Hence we need to make sure that the quality and precision of the scored data is comparable between the different labs.

The forest authorities and logging companies in the different African countries might stay skeptical about the developed reinforcement tools. As a consequence we will try to involve them as much as possible in the project. Good results of the blind tests should convince them on the power of the enforcement tools.

As measures of capacity building and technology transfer three reference labs in West-Africa (Kumasi, Ghana), Central-Africa (Libreville, Gabon) and East-Africa (Nairobi, Kenya) will be established and staff of these labs but also from other African groups will be trained to apply DNA-techniques and wood anatomy to identify the tree species and to perform simple DNA tests to check the origin. This capacity building and the plan to integrate the genetic and chemical reference data bases into the international coordination office for tree identification and origin assignment at Bioversity International in Malaysia will help that the project's results will be sustained after its completion. Moreover by the integration of private labs into the project we hope to open a pathway for commercial application of the assignment after the project ends.

The Institute of Forest Genetics at the Johann Heinrich von Thünen Institute in Germany is the executive agency and coordinator of the project. Besides the vTI, five different genetic labs in Europe and Australia will share the genetic work of the project (Université Libre de Bruxelles - Belgium; Gembloux Agro-Bio Tech - Belgium; University of Adelaide – Australia; NERC Centre for Ecology and Hydrology – UK and Plant Genetic Diagnostics GmbH, Germany). The work of the isotopes will be done in Europe by TÜV Rheinland AgroIsolab – Germany; The Food and Environment Research Agency – UK and by the AIT Austrian Institute of Technology GmbH- Austria. As collaborative agencies in Africa the Forest Research Institutes of Ghana and Kenya as well as the Institute de Recherche en Ecologie Tropicale (IRET) in Gabon will participate in the project. The further development of the macro- and microscopic wood anatomical tree identification will we done by the Institute of Wood Technology and Wood Biology of the vTI. The Gembloux Agro-Bio Tech, The Forest Trust (TFT), the World Wild Fund for Nature together with several local partners in the African countries will do the sampling for the reference data bases and for the blind tests.

The original plan was to work on seven target tree species. The budget estimated for that was 3.000.000 to 4.000.000 US$. During the pre-project phase we worked on additional funding opportunities but we could get only a conformation on the 1.7 million US $ given by the German government (BMELV) in June 2011. Two satellite projects covering complementary part of the ITTO work programme have been submitted by the University of Adelaide and the vTI at the Australian Research Council (requested additional budget = 723,000 US$) and by the Ghana Forestry Commission to the ACP-FLEGT call (requested additional budget = 134,000 US$). By September 2011 we got a positive evaluation for the Australian proposal and a negative decision for the ACP-FLEGT proposal. We are working on a resubmission of this proposal to another call. We are in close discussions with the US government and the government of Austria who have signaled their interest to give additional funds via ITTO to the project. The plan for this is to work on an "enlargement" proposal for the next ITTO proposal deadline in January 2012.

LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation	Full description
AFLEG	Africa Forest Law Enforcement and Governance
AIT	AIT Austrian Institute of Technology GmbH
BFW	Federal Research and Training Centre for Forests, Natural Hazards and Landscape
BMELV	German Federal Ministry for Food, Agriculture and Consumer Protection
CBD	Convention on Biological Diversity
CENAREST	Centre National de la Recherche Scientifique et Technologique (Gabon)
CIFOR	Center for International Forestry Research
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CoC	Chain of Custody
COMIFAC	Central African Forests Commission
DBU	Deutsche Bundesstiftung Umwelt
DNA	Deoxyribonucleic acid is a nucleic acid
EFI	European Forest Institute
EIA	Environmental Investigation Agency
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FBCIB	Belgian Timber Importers' Federation
FERA	The Food and Environment Research Agency
FERN	Tracking EU policies, focusing on forests
FLEGT	European Commission Action Plan on Forest Law Enforcement, Governance and Trade
FSC	Forest Stewardship Council
GABT	Gembloux Agro-Bio Tech
GDHolz	German Timber Trade Federation
ITTA	International Tropical Timber Agreement
IUCN	International Union for Conservation of Nature
IUFRO	International Union of Forest Research Organizations
LVBC	Lake Victoria Basin Commission
LCB	French Timber Trade Federation
LATF	Lusaka Agreement Task Force
NERC	NERC Centre for Ecology and Hydrology
PAGEF	Project for the sustainable management of the forest in Congo
PAPPFG	Project for managing small Gabonese forest licenses
PARPAF	Reinforcement project to the establishment of forest management plan in the Central Africa Republic
PEFC	Programme for the Endorsement of Forest Certification
PGD	Plant Genetic Diagnostics GmbH
SCS	Scientific Certification Systems
SGS	Inspection, verification, testing and certification company
SNV	Netherlands Development Organization
TFLET	ITTO Thematic Programme on Forest Law Enforcement, Governance and Trade
TFT	The Forest Trust
TPD	Thematic Programme Document
TVU	TÜV Rheinland, AgroIsolab
UA	University of Adelaide
UK DFID	United Kingdom - Department for International Development
UK-TTF	UK Timber Trade Federation
ULB	Université Libre de Bruxelles
vTI	Johann Heinrich von Thünen-Institute – German Federal Research Institute for Rural Areas, Forestry and Fisheries
vTI-FG	vTI - Forest Genetics
vTI-HH	vTI-Wood Technology and Wood Biology
VVNH	Dutch Timber Trade Federation
WWF	World Wide Fund For Nature

MAP OF PROJECT AREA

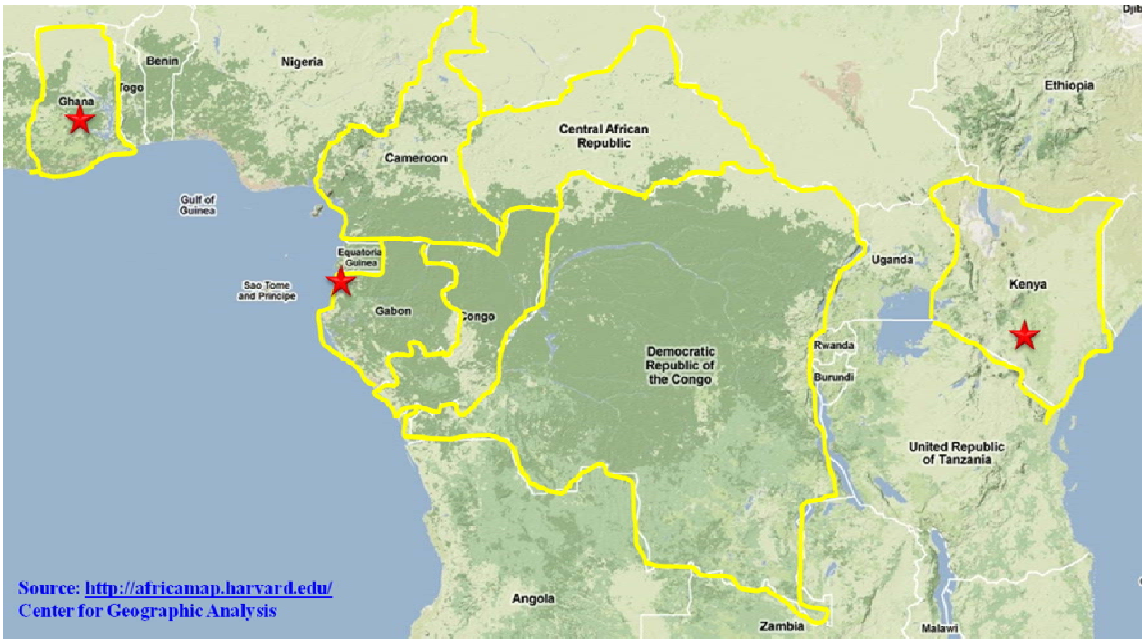


Fig. 1: Map showing the seven African countries involved in the project. The borders lines of the countries are delimited in yellow. The red stars indicate the location of the three genetic reference laboratories in Kumasi (Ghana), Libreville (Gabon) and Nairobi (Kenya).

Fig. 2: Distribution maps of the three target species in Africa

PART 1. PROJECT CONTEXT

Origin

This project is the direct outcome of the ITTO pre-project TFL-PPD 023/10 Rev.1 that has been executed by the Johann Heinrich von Thünen Institute (vTI) in collaboration with The Forest Trust (TFT) from October 2010 to May 2011. The objectives of the pre-project were:

- To provide an overview to the state of the art in the involved African countries
  - Forest exploitation and trade with different tree species, situation with illegal logging, timber exports to Europe
  - Existing timber tracking projects/ activities
  - Present results on existing genetic and isotopic patterns for tree species in the region
- To develop the work programme for the main project
  - Select high priority tree species for timber tracking and species identification in the involved African countries
  - Define the contributions of the different genetic and isotope labs
  - Clarify the used methods (gene markers, isotopes, sample design) and estimate the requested budget
  - Develop a first draft of the project Grant chart
- To present the project to potential stakeholder and discuss their expectations and potential contribution
- To work out a strategy to get additional funding for the project

For this purpose two workshops were held with potential partners and stakeholders: one in Hamburg (Germany) from 1st to 3rd of March 2011 and one in Yaoundé (Cameroon) from 23rd to 24th of March 2011. 32 persons from 10 countries (Europe + Singapore + Australia + USA) and 50 persons from 10 countries (7 African project countries + Germany + USA + Singapore) participated to the workshop in Hamburg and Yaoundé respectively.

The Forest Trust (TFT) supported the vTI with the organization of the workshop in Cameroon and got in contact with the ITTO focal points in Africa to secure their support for the project (see letters of support).

Relevance

1.1.1 Conformity with ITTO's objectives and priorities

The project is in complete compliance with two objectives of the ITTA 2006: the objective ***n*** "*Strengthening the capacity of members to improve forest law enforcement and governance, and address illegal logging and related trade in tropical timber*" and the objective ***p*** "*Promoting access to, and transfer of, technologies and technical cooperation to implement the objectives of this Agreement, including on concessional and preferential terms and conditions, as mutually agreed*". Furthermore, it is in conformity with the ITTO action plan 2008-2011 listing as a possible action by ITTO members *to "develop, test, apply and disseminate functional timber-tracking systems*".

The planned project fits directly to the former ITTO thematic call for proposals on TFLET. The Programme strategy recognizes that strengthening forest governance and elimination of illegal logging and illegal trade are a shared responsibility between producer and consumer countries. The strategy comprises four main areas of intervention. Our project falls in the second area of intervention: "*support to production and marketing of legally produced tropical timber and effective management of supply chains*". Here the TPD explicitly states that projects focused on the "*implementation of timber-tracking systems*" could be supported. In addition, the planned project addresses issues under the fourth area of intervention of TFLET, namely: "*strengthening of international and regional cooperation*".

1.1.2 Relevance to the submitting country's policies

The project is directly linked to the German national policies in support of the European Union's FLEGT Action Plan. While the EU FLEGT Action Plan provides measures to support developing countries to achieve improved forest governance, it also provides for Voluntary Partnership Agreements between timber-producing developing countries and the EU. The project concentrates on African countries that have finalized or are negotiating a "Voluntary Partnership Agreement" with the EU. The latter requires partner countries to

implement a timber licensing scheme and EU border control agencies to allow imports from these countries only if they are accompanied by FLEGT licenses. Within the implementation of the timber licensing scheme, partner countries in the Congo Basin are expected to develop computerized national tracking systems aimed to serve as a source of information and a real time control tool for government agencies such as ministries of forests, taxation and customs departments. According to the EU, the tracking systems should be reliable, cost efficient and forgery proof, something that can only be achieved if physical controls at critical points are intensified. This is where robust methods to verify the origin of timber such as DNA and isotopic analyses of timber would complement existing methods and help demonstrate the exact origin of wood.

Moreover and most recently, the EU implemented further legislation concerning due diligence of operators placing timber on the EU internal market.

Several initiatives of Central African countries providing support to logging companies in the development of management plans are also linked to the project insofar as they aimed at improving legality of timber trade and better forest management. In Gabon, one could mention the PAPPFG project, an initiative funded through a mechanism of dept for nature swap by France. In the Central African Republic, there is PARPAF, a joint SNV - UK DFID programme focusing on supporting non-state actor's engagement with the state to implement Cameroon's Forest & Environment sector programme, and in Congo-Brazzaville, the PAGEF project comes to mind. By helping forestry companies to fulfill the baseline criteria of having an approved management plan which is a first step in improving forest management and is also key in the process of accessing FLEGT legality licenses and legality verification in general, the fingerprinting project could support and complement these initiatives as both, FLEGT licensing requirements and legality verification require a good degree of traceability.

The three East African countries (Kenya, Uganda and Tanzania) are party to the Lusaka Agreement Task Force (LATF), a legally-binding agreement to reduce and ultimately eliminate illegal trade in wild fauna and flora, which also includes trade in forest products. The task force, which is headquartered in Nairobi, provided impetus for the East African FLEGT process spearheaded by the Lake Victoria Basin Commission (LVBC) to promote sustainable forest management in the region. The inaugural East African FLEGT meeting in Arusha, Tanzania in September 2006 recognised that its member states are recipients or transit points of illegally harvested and traded forest products and hence the need for improving institutional capacity to stem the vice and sustainably manage forests in the region. In Kenya, forest governance is undertaken through the Forests Act (Kenya Gazette Supplement No. 88, Act No. 7) that provides for the establishment, development and sustainable management, including enforcement of the conditions and regulations pertaining to logging, licensing and granting of concessions. The Act also commits Kenya to international conventions and other agreements to promote the sustainable management, conservation and utilisation of forests and biological diversity.

Furthermore, the project should help improve the submitting countries' monitoring and control of the CITES species that have been selected for the project. Forest policies in all submitting countries are dealing with the monitoring and control of these species and most of them have only had limited success so far. Better traceability methods (such as the ones to be developed by the fingerprinting project) are expected to improve the monitoring and identification of CITES species by customs authorities.

The Congo Basin Forest Partnership in close cooperation with the COMIFAC is also aimed at promoting the conservation and sustainable management of the Congo Basin's forest ecosystems. It was launched at the 2002 World Summit on Sustainable Development in Johannesburg and represents a voluntary multi-stakeholder initiative contributing to the implementation of an intergovernmental commitment, i.e. the Yaoundé Declaration.

In addition the project will also focus on Kenya as an important transit country, through which illegally logged timber can reach ports and international markets. For all of these ends, which require the strengthening of certification, tools to facilitate the proper identification of timber origins and identity is gaining increasing importance. Not least, these tools would also provide substantial benefits for consumers in verification of product quality and standards of production.

Target Area
1.1.3 Geographic location

This is a multinational project targeting primarily seven African timber producing or transit countries, but also involving different partner research institutes from Europe and Australia. The African countries concerned are Cameroon, Central African Republic (CAR), Democratic Republic of Congo (DRC), Congo Republic, Gabon, Ghana and Kenya. The forests of Cameroon, CAR, DRC, Congo, Gabon and relics of Kenya are part of the Congo Basin. The forests of the Congo Basin constitute the second largest area of dense tropical rainforest in the world. They stretch from the coast of the Gulf of Guinea in the west to the mountains of the Albertine Rift in the east and cover about seven degrees of latitude on either side of the equator. They are mostly within the Guinea-Congo forest structure. In the west of Cameroon and the east of the Democratic Republic of Congo, they also include the Afromontane forests[1]. Ghana is located in the West Coast of Africa, about 450 km north of the equator between latitudes 4 and 11.5º North and longitudes 3.11º West and 1.11º East. The southern part of Ghana is within the West African rainforest block at the eastern part of the Dahomey Gap. Though Kenya is less forested than the other countries, it strategic position in eastern Africa with a direct access to the Indian Ocean makes it an important timber transit country

1.1.4 Social, cultural, economic and environmental aspects

The seven African countries cover a total land area of 4.758.610 km² and in 2009 had a population of more than 158,7 million inhabitants. In general 62,1% of the population lives in rural areas depending mostly on subsistence agriculture and natural resources to survive. The small populated countries (Gabon and Congo) have a higher percentage of their population living in urban areas.

The analysis of the indicators in table 1 revealed that there is a widespread poverty in the sub-region. DRC, CAR and Kenya - which when combined represent more than 69,4 % of the total subpopulation - are classified among the lowest income countries in the world (GNI/inhabitant < $ 995, according to the World Bank ranking, 2011). Additionally, Cameroon and Congo are classified as lower middle income countries. Only Gabon, representing less than 1% of the population is upper income country. There is also a high degree of disparity in the distribution of the national wealth (Gini index) and this is usually in disfavor of the rural populations (World Bank, 2011).

Data on industrial logging contribution to the country GDP is available for three countries and range from 4 and 13%. Assessing actual levels of illegal activity is very difficult and can be imprecise[2] and data are not available for all countries. Table 2 summarizes the findings of some estimates that varies between 30 and 50% of the country production.

Table 1: Summary of economic development indicators in the African target countries

Country	Region	Population (millions of inhabitants)	Density (population/km²)	Rural population (% of total population)	Life expectancy (years)	GNI* (billion US $)	GNI/inhabitant ($/inhabitant)	Gini index**
Cameroon	Central	19.521.645	41,30	42,42	51,36	22,06	1129,97	44,6
Congo		3.683.182	10,79	38,28	53,71	6,87	1864,86	47,3
DRC		66.020.365	29,12	65,42	47,77	9,83	148,90	44,4
Gabon		1.474.586	5,72	14,48	60,87	9,55	6475,75	41,5
CAR		4.422.397	7,10	61,26	47,30	1,98	448,47	43,6
Ghana	West	23.837.261	104,76	49,24	56,82	25,87	1085,30	42,8
Kenya	East	39.802.015	69,93	78,10	54,89	29,31	736,41	47,7

Source: World Bank, 2011

* *GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad.*

** *Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.*

Apart of the slash-and-burn shifting agriculture, the majority of inhabitants of the Congo Basin harvest forest products for both food (non timber forest products) and domestic energy (fuelwood and charcoal). Forests cover 52,4% (2.494.740 km²) of the total land area in the seven partner countries [3] (Table 2). Apart of DRC,

[1] Congo Basin Forest Partnership (CBFP) 2006. *The forests of the Congo Basin –state of the forest report 2006*

[2] Lawson S. and MacFaul L., 2010. Illegal logging and related trade: indicators of the global response, The Chatham House, UK, ISBN 978 1 86203 235 4.

[3] FAO, 2010. *Global Forest Resources Assessment 2010*

the permanent forest estate is 56,9% of the total forest area. The forests are owned by the states in most countries except Kenya where 61% are private properties.

The proportion of forest area with management plan is low in all countries varying between 4 and 39%. Due to the lack of management plan, the logging is not always sustainable in production forests and the maintenance of protected areas is crucial to maintain biodiversity.

Only a mere 4.606.599,15 hectares (1.85% of the combined forest area of the seven countries) is certified by the Forest Stewardship Council (FSC)[4] by May 2011. Environmental impacts of logging (legal and illegal) are widespread in this situation and included damage to the residual stand, fragmentation, various disturbance, soil erosion and pollution of watercourses, reduction of regeneration, loss of genetic diversity, invasion of exotic species etc.

Table 2: Forest related indicators in the African target countries

Criteria		Cameroon	Congo	DRC	Gabon	CAR	Ghana	Kenya
Land area (1 000 ha)		47.271	34.150	226.705	25.767	62.300	22.754	56.914
Forest	1 000 ha	19.916	22.411	154.135	22.000	22.605	4.940	3.467
	% of land area	42	66	68	85	36	22	6
Primary forest	1 000 ha	-	7436	-	14334	2370	395	654
	% of forest area	-	33	-	65	10	8	19
Ownership pattern	Public ownership	100	100	100	100	91	100	39
	Private ownership	0	0	0	0	0	0	61
	Other	0	0	0	0	9	0	0
Holder of management rights of public forests	Public administration	56	42	90	100	1	-	100
	Business entities and Institutions	41	58	10	0	15	-	0
	Communities	3	0	0	0	0	-	0
	Other	0	0	0	0	84	-	0
Permanent forest estate	1 000 ha	18.048	15.203	-	10.000	5.073	4.543	1.364
	% of forest area	91	68	-	45	22	92	39
Forest within protected areas	1 000 ha	9.105	986	16.297	3.434	247	43	-
	% of forest area	46	4	11	16	1	1	-
Forest with management plan	1 000 ha	7.847	5.417	6.591	7.500	3730	971	824
	% of forest area	39	24	4	34	17	20	24
Industrial roundwood (1 000 m³ over bark)	1990	58	404	-	200	-	80	-
	2000	372	424	2.282	689	-	130	2.812
	2005	383	435	2.175	634	-	130	3.368
FSC certified forest area by 2011	ha	763.146	2.727.996	-	1.873.505	-	1.778	2.557
	% of forest area	3,83	12,17	-	8,52	-	0,04	0,07
Exported volume (m³)	Logs	266.000	522.497	208.087	1.938.079	193.213	87.085**	-
	Sawn wood	613.000	209.122	30.382	157.856	76.042	191.382**	-
	Peeled veneer	64.286	15.307	0	144.135	4.300	69.679**	-
	Sliced veneer	3.204	0	1.392	1.889	0		-
	Plywood	22.000	1.755	6.762	28.384	740	138.392**	-
	Planed sawn wood, flooring, moulding	3.205	0	1.152	0	0	-	-
	Log for pulp and paper	0	250.746	0	0	0	-	-
Forest revenue	1 000 $	46.896	47.396	-	16.478	7.945	-	-
Industrial logging contribution to GDP	% of country GDP	5,11	-	4,10	13.04	-	-	-
Estimate of illegal logging	% of production	30[5]	-	-	30[5]	-	30[5]-50[6]	-

GDP: Gross domestic products; Sources: FAO, Global Forest Resources Assessment 2010; * The Forests of the Congo Basin - *State of the Forest 2008*, Editors : de Wasseige C., Devers D., de Marcken P., Eba'a Atyi R., Nasi R. and Mayaux Ph., 2009, Luxembourg: Publications Office of the European Union, ISBN 978-92-79-13210-0, doi: 10.2788/32259; ** ITTO, 2009. *Annual review and assessment of the World timber situation 2009*

[4] FSC, 2011. *Global FSC certificates: type and distribution*

[5] American Forest & Paper Association from: Seneca Creek Associates and Wood Resources International, 2004, "Illegal" Logging and Global Wood Markets: The Competitive Impacts on the US Wood Products Industry." Prepared for American Forest & Paper Association. www.afandpa.org

[6] The Forestry Commission of Ghana, 2003, *Keynote Address by Hon. Prof. Dominic K. Fobi*—Minister for Lands & Forestry: www.fcghana.com/news/ministers_speech_afleg.htm

Expected outcomes at project completion

We expect three main outcomes of the project:

- A better enforcement of forest laws and regulations by improved verification and monitoring procedures

The developed genetic and isotopic reference database will enable governmental authorities in timber producer and timber consumer countries to control the declared country of origin for Iroko, Sapelli and Ayou. The project database will be integrated into the open access database at the coordination office of Bioversity International in Malaysia. Thus also NGOs (WWF, EIA etc) and timber traders could use it via accredited genetic and isotopic labs to check the declared country of origin for timber at any step in the chain of custody.

The pilot studies for the DNA based tree by tree check of the chain of custody in Ghana will stimulate the transfer of the technologies from public research Institutes to the private sector. The private company Double Helix Tracking Technology (http://www.doublehelixtracking.com) is already applying this DNA based audit approach as a commercial service for timber trader that import legality proofed merbau (*Intsia* sp.) from Indonesia and Papua New Guinea to Australia.

- Improved tools to control the trade with CITES protected species and species that could be confounded with them

Within the project the tools for species identification of 20 African species will be developed. Among the 20 species are CITES protected species and species that can be confounded with them. Again governmental authorities responsible for CITES, NGOs and the private sector will make use of these tools to check the species identification. Moreover the new EU timber regulation and the US Lacy act ask for a declaration on the botanical species. Thus improving tools for species identification will directly support authorities in timber producer and timber consumer countries responsible for the control of those declarations.

- A transfer of know-how and capacity building in timber producer and timber transit countries

Three genetic reference labs to apply the DNA methods of the project will be established in Africa. 10 persons from Africa will be trained in high level genetic and isotopic labs in Europe and Australia. And various training workshops will be done during the planned ITTO project. Thus at the end of the project the timber producer countries should be able to continue with the species and origin control by themselves.

PART 2. PROJECT RATIONALE AND OBJECTIVES

Rationale

2.1.1 Institutional set-up and organizational issues

Fourteen partners belonging to six timbers consuming countries and numerous partners from the seven African timber producing countries will work together to implement the project.

Partners from consumer countries are mainly universities and research institutes experienced in DNA and isotopes fingerprinting techniques. They have been conducted joint-researches for years on various topics (some related to timber tracking) and there is a great level of coordination among them. Their scientific performance is demonstrated by many publications in high ranking international journals. In March 2011 during the pre-project all potential partners from Europe and Australia participated at a project preparation workshop in Hamburg.

The Institute of Forest Genetics at the Johann Heinrich von Thünen Institute (FG-vTI) in Germany will be the executive agency and coordinator of the project. Since 10 years the FG-vTI is working on the topic of DNA fingerprinting for timber tracking and DNA barcoding of trees. The Institute contributed to 5 different pilot studies in this area in Africa, Latin-America and South-East-Asia and organized several international workshops on this topic (e.g. Königswinter 2007; http://literatur.vti.bund.de/digbib_extern/dk040646.pdf). The capability to co-ordinate large project has been demonstrated in a few large European research projects and cost actions. The FG–vTI has collected important experiences on the project management in relation to the ITTO during the pre-project (TFL-PPD 023/10).

Besides the vTI, five different genetic labs in Europe and Australia will share the genetic work of the project (Université Libre de Bruxelles - Belgium; Gembloux Agro-Bio Tech - Belgium; University of Adelaide – Australia; NERC Centre for Ecology and Hydrology – UK and Plant Genetic Diagnostics GmbH, Germany). The work on isotopes will be done in Europe by TÜV Rheinland AgroIsolab – Germany; The Food and Environment Research Agency – UK and by the AIT Austrian Institute of Technology GmbH- Austria.

As collaborative agencies in Africa the Forest Research Institutes of Ghana and Kenya as well as the IRET in Gabon will participate in the project. At these three African Institutes already existing genetic labs will be further developed to genetic reference labs. At the end of the project these labs should be able to use gene markers to identify species (DNA) barcoding and to assign the country of origin. The capability and potential of the three African labs have been proofed during common research with European partners (IRET in Gabon together with the Université Libre de Bruxelles – Belgium, the Kenya Forest Research Institute together with NERC Centre for Ecology and Hydrology – UK) and in case of Ghana a mission of the pre-project co-coordinator to Kumasi was done to check the potential of the lab in April 2011. Graduate and postgraduate students of these groups have already been trained in Europe. The project will re-enforce the capacities of the African partners by 3 month training courses given to 10 persons, by specific training missions to Africa and by additional equipment. Ring test will be organized among the labs to guarantee same standard of analysis.

The further development of the macro- and microscopic wood anatomical tree identification will we done by the Institute of Wood Technology and Wood Biology of the vTI. This Institute is the world leader in this area. The University Gembloux Agro-Bio Tech, The Forest Trust (TFT), the World Wild Fund for Nature (WWF) together with several local partners in the African countries will do the sampling for the reference data bases and for the blind tests. The partners have got lots of experiences on that during projects in the past (e.g. Gembloux Agro-Bio Tech during several projects in West and Central Africa; TFT during a Europe-Aid project on DNA and isotope fingerprinting in Cameroon, and WWF during projects funded by the German DBU working on isotope fingerprinting in Russia, South-East Asia and Latin-America)

The contribution of each partner of the timber consumer countries to the project was discussed during the workshop in Hamburg. All African partners and stakeholders pledged to support the project and theirs contributions have been discussed in Yaoundé. The sampling of cambium and leaves from several species across seven countries is a huge task that will require a good level of organization and collaboration. The participants recommended the creation of a small coordination unit regrouping various stakeholders (forest administration, forest concessionaires, research institutes, development projects) in each country. They will facilitate access to the sampling sites and can also help in collecting samples directly.

2.1.2 Stakeholder analysis

Table 3: Stakeholder analysis

Stakeholder group	Characteristics	Problems, needs, interests	Potentials	Involvement in the project
Primary stakeholders				
Forest concessionaires	Derive revenues from timber logging	Face concurrence from illegally logged timber; concern about practical field application of the system; concern by what will happen to the current timber tracking methods; concern by the cost and who will be paying for that	Have good knowledge of timber resources	Primary project beneficiaries, will assist for sampling
Timber trade federations and private companies	Derive revenues from timber and timber products trade	Wait to see proofs that the system works and to know how it will be linked with current regulations; concern by the cost	Experienced in the wood and wood-based products market	Primary beneficiaries, can supply samples for blind test
FLEGT + CITES control authorities in timber producer and timber consumer countries	Are responsible for the legality control of timber exports and imports	Need reliable tools to control species and origin, may have wrong expectations on the costs, need to know which method is suitable for which control	Can specify the control needs	beneficiaries
Secondary stakeholders				
NGO's and development agencies	Actively involved in the sustainable management of natural resources	Want to develop small verification kits usable directly in the field	Experienced in working with various stakeholders from developing and developed countries	Can help during sampling, training and capacity building. Will organize the blind test, Can multiply the funding and lead in the extension of the system
African forest administrations	Make, implement or control forest management plans	Need training for sampling and implementation of the system	Experienced in existing timber tracking systems; knowledge of African forests, can mobilize staff for assistance	Can assist for sampling, can provide authorization and assistance to sample in protected forests and concessions
African governments	Make and implement forest laws	Needs to have unfalsifiable control methods guaranteeing the origin of wood and wood products	Desire to stop illegal logging, have the authority and influence to implement new timber tracking system	Primary project beneficiaries, Can incorporate the system into forest laws

Stakeholder group	Characteristics	Problems, needs, interests	Potentials	Involvement in the project
Certification	Attest the origin of wood raw material and its status and/or qualifications, have systems designed to measure forest management practices against standards and to demonstrate compliance with those standards	Low percentage of African forest certified; specific ecological, social and economic performance indicators can be manipulated along the chain of custody; needs to have indicators that cannot be manipulated	Experienced in working with stakeholders the timber industry	Primary project beneficiary, can use the DNA and isotopes fingerprinting techniques to increase certification standards
Tertiary stakeholders				
African regional organizations: The Central African Forests Commission (COMIFAC)	Primary authority for decision-making and coordination of sub-regional actions and initiatives pertaining to the conservation and sustainable management of the Congo Basin forests	Project cover some of their strategic priorities: knowledge of the resource, management of ecosystems; sustainable exploitation of forest resources, monitoring, strengthening of capacities, training; research development	Authority and influence in the region	Desire to be member of the steering committee and to coordinate training and education activities
Western countries governments	Make and implement forest laws	Have laws and regulations prohibiting the placing on the market of illegally sourced timber; From 2013, the EU-timber-trade-regulation will oblige operators to prove the origin of wood and wood products imported to the internal EU-market; needs unfalsifiable methods to control the origin of wood and wood products	Great desire to stop illegal logging, have already appropriate laws and the means to enforce them	Supporting the project financially, will apply the system to track timber
International organizations: (Bioversity International)	Carry out global research to seek solutions for sustainable agriculture, nutrition and conservation; host the newly established international facility “Identification of Timber Species and Origins”	Want to use the international database as a tool to promote the up-scaling of DNA and isotope fingerprinting techniques; needs supports from all institutions working in the field	Competence in coordinating research, setting standards, and establishing network	Will host the project reference database
Western countries universities and research institutes	Have education and research missions	Lack means to finance new timber tracking researches	Competence in research, studies and training	Will collaborate in implementing project activities, might look for additional funding

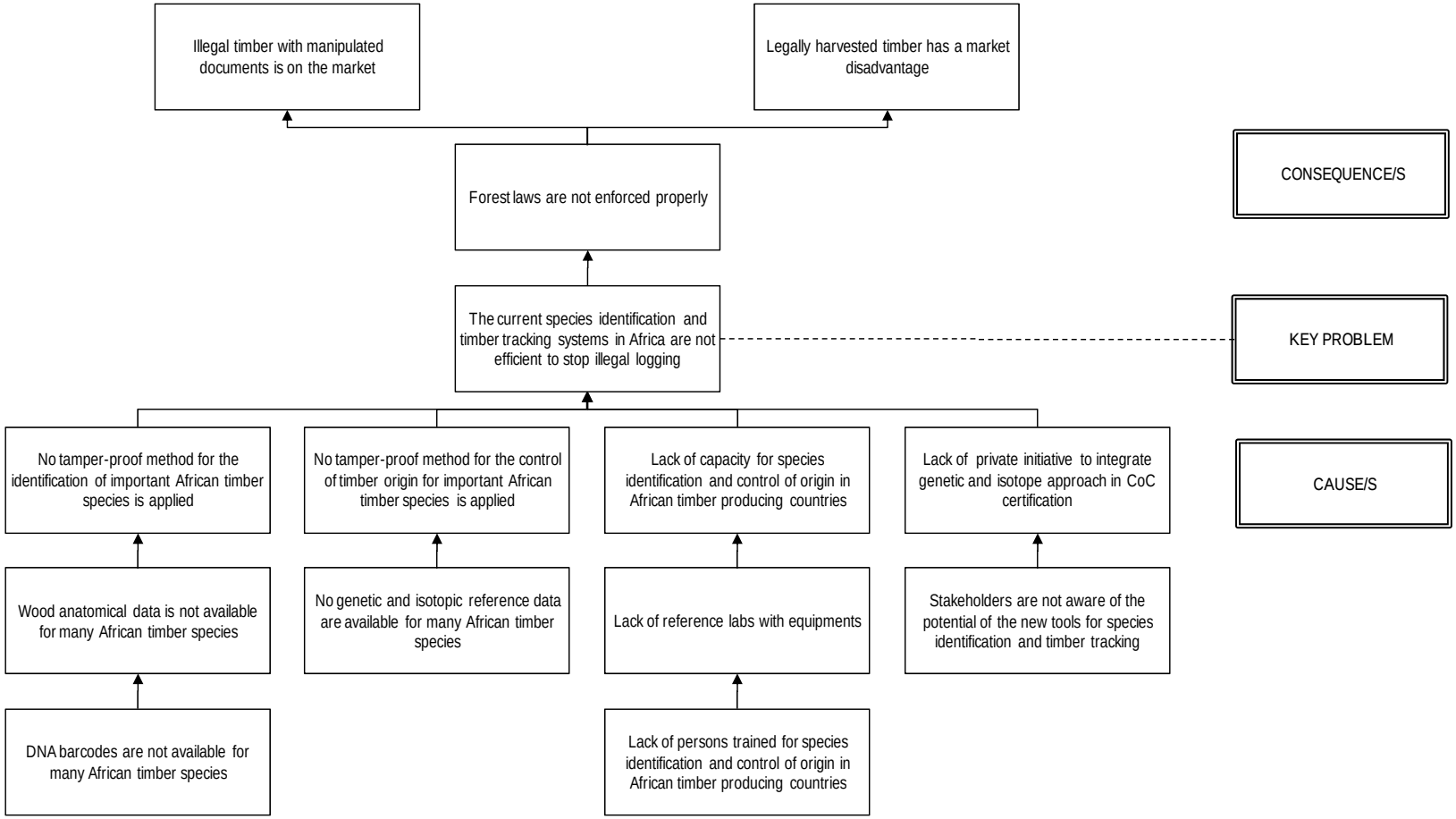
Stakeholder group	Characteristics	Problems, needs, interests	Potentials	Involvement in the project
Western commercial labs (AgroIsolab GmbH, PGD GmbH, Doublehelix)	Provide service on origin checking for public authorities, NGOs and forest companies	Needs to get better access to the market	Important pathway of technology transfer and durable application of the project's results	Will do part of the genetic and chemical screening for the reference data bases and will participate in blind tests
African universities and research institutes	Have education, training and research-development mandates	Lack: means to finance researches, isotope laboratory, DNA fingerprints laboratory in most countries; Needs: training of trainers, education of young scientists; Interests: host reference laboratory or have small equipments necessary to perform timber tracking works	Competence in research, experienced in teaching and training in Africa	Can assist in sampling; desire to organize training and education activities; desire to include know-how and knowledge generated by the project into curricula of existing degree and non-degree programmes

2.1.3 Problem analysis

The key problem that we want to address with the project is the inefficient tree species identification and control of timber origin in Africa. The consequences are that existing forest laws and regulations against illegal logging are not enforced properly. As long as this is the case illegal timber with manipulated documents suggesting legality is on the market. And because the costs for illegal timber are significantly lower this goes along with a market disadvantage for legally harvested timber.

What are the causes of the missing application of tamper proof methods?

Since more that 100 years wood anatomical approaches are known to be very useful for the identification of tree species. But for many important African timber species, the keys for species identification by wood anatomy haven't been worked out yet. And for a significant part of the species the wood anatomical approach is not sharp enough to distinguish between different species of the same genus. The modern alternative is the genetic barcoding. This approach searches for genetic differences among species and develops gene markers that screen these differences. But for many species worldwide, we still need to develop the genetic barcodes. Genetic and isotopic fingerprints are two complementary and very reliable approaches to control the origin of timber. Unfortunately, for the important African timber species the reference data with the spatial pattern of the fingerprints in the species distribution areas have not been worked out yet. And there are two additional causes for the lack of application of the approaches in the timber producer countries in Africa: a) there are no reference labs with trained persons and sufficient equipment, and (b) no private initiatives have been started so far to integrate the modern methods in certification schemes to ensure legality along the chain of custody. Lack of initiatives of various stakeholders group (private sector, African governments, NGOs, development agencies etc.) in this area is also caused by a the low level of information on the potentials of the new tools.

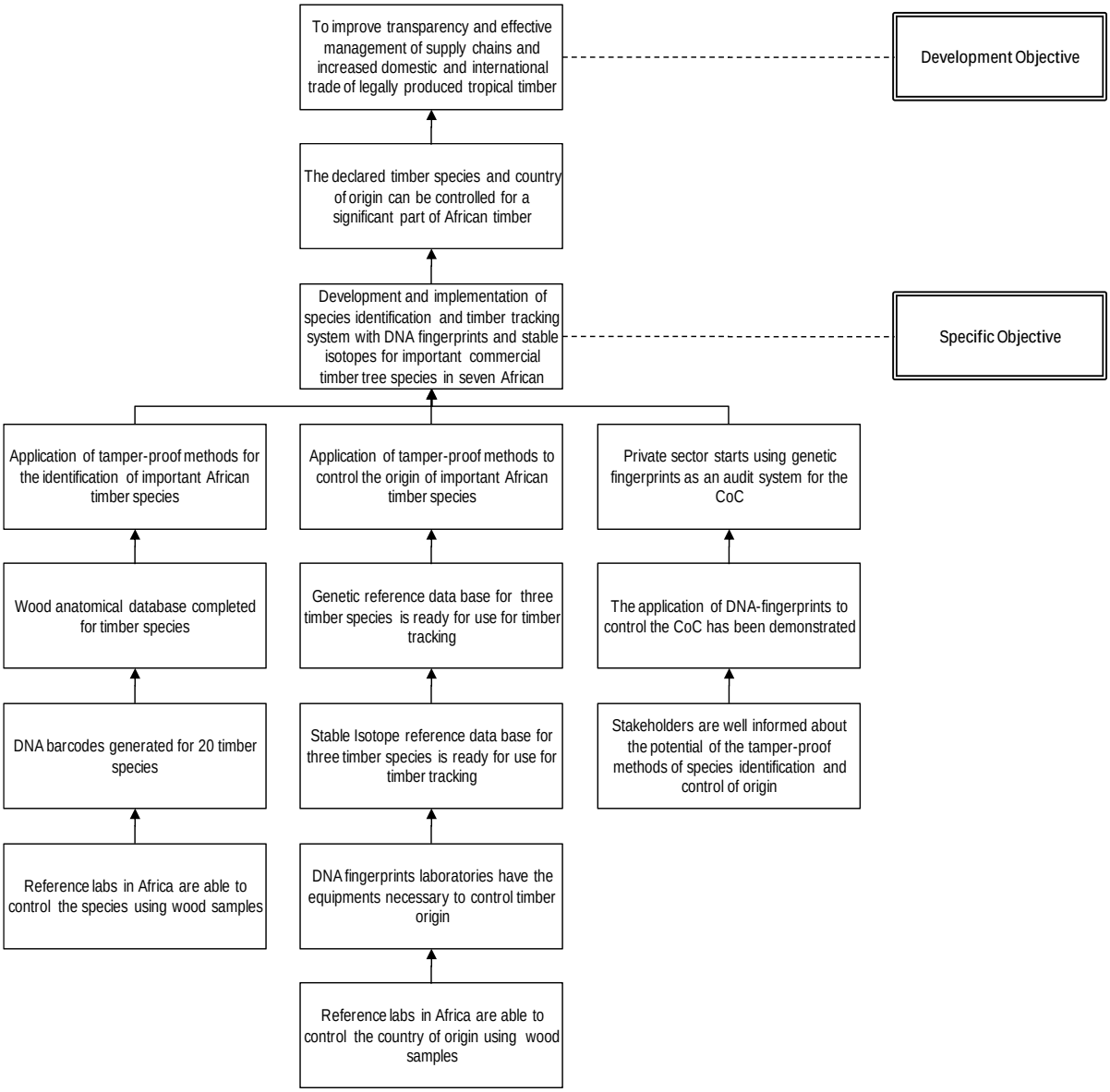

Illegal timber with manipulated documents is on the market
Legally harvested timber has a market disadvantage
Forest laws are not enforced properly
CONSEQUENCE/S
The current species identification and timber tracking systems in Africa are not efficient to stop illegal logging
KEY PROBLEM
No tamper-proof method for the identification of important African timber species is applied
No tamper-proof method for the control of timber origin for important African timber species is applied
Lack of capacity for species identification and control of origin in African timber producing countries
Lack of private initiative to integrate genetic and isotope approach in CoC certification
CAUSE/S
Wood anatomical data is not available for many African timber species
No genetic and isotopic reference data are available for many African timber species
Lack of reference labs with equipments
Stakeholders are not aware of the potential of the new tools for species identification and timber tracking
DNA barcodes are not available for many African timber species
Lack of persons trained for species identification and control of origin in African timber producing countries

2.1.4 Logical framework matrix (need to be adapted)

PROGRAM ELEMENTS	INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Development Objective: To improve transparency and effective management of supply chains and increased domestic and international trade of legally produced tropical timber	• By 2015, 20% of wood and wood products exported from Africa can be traced back to their country of origin with DNA or stable isotopes and for 80% of the exported timber the tree species can be identified • By 2016, certification standards have integrated DNA or stable isotopes as additional audits	• Statistics of public control agencies • Certifications standards • Workloads at the reference laboratories • Requests to the central data base at Bioversity International	• DNA and stable isotopes timber tracking system introduced into countries policies and practices • Commitments from timber importing countries to use the system
Specific Objective: Development and implementation of species identification and timber tracking system with DNA fingerprints and stable isotopes for three commercial timber tree species in seven African countries	• By 2014, a species identification based on wood anatomy and DNA barcode is available for 20 African timber species • By 2015, a DNA and stable isotopes fingerprints timber tracking system is ready for use for three African timber species • By 2015, African partners are doing independently timber tracking with DNA fingerprints in Africa	• Project reports and publications • Online databases • Established timber tracking systems	• Strong commitments from timber producing countries governments to participate to the project • Strong supports from partners and stakeholders
Output 1: 20 African tree species have been identified by wood anatomy and DNA barcode	• By the end of the project, a computer-aided identification and description of the 20 African timber species is available • By the end of the project, the DNA barcode sequences of 20 African timber species is completed	• Wood anatomy database • Barcode sequence database	• Presence of variation in wood anatomic features • Presence of variation in DNA barcode sequence

Output 2: Genetic and stable isotopes reference data to control the country of origin for three important timber species have been established	By the end of the 2nd year, sampling of wood probes, cambium or leaves is completed in the seven countries By the end of the project, a spatial genetic reference database of 3 important African timber species is available online By the end of the project, a spatial stable isotopes reference database of 3 important African timber species is available online	Report of field sampling Genetic reference database Stable isotopes reference database	Strong commitments from timber producing countries partners and stakeholders to support sampling Presence of DNA sequence variation in the genome of each species showing clear spatial genetic pattern Stable isotopes show sufficient variation at regional level
Output 3: African timber producer countries equipped and their personal trained for timber species identification and control of origin	By the end of the project, timber producer and timber transit countries have been equipped to do species identification and timber tracking with DNA fingerprints techniques • By the end of the project, 10 persons are trained to conduct independently DNA-fingerprinting timber tracking, and to interpret stable isotopes data • By the end of the project, 2 training courses for 50 participants in total have been organized	Equipments provided to timber producer and timber transit countries Training reports	Commitments from timber producer and timber transit countries to use and maintain the equipment for timber tracking purpose • Commitments from timber producer and timber transit countries to have staff members trained • Commitments of partners staff members to do the training
Output 4: Demonstration of control of chain of custody have been done with two tree species and stakeholders have been involved	By the end of the 3rd year, timber of individual trees of sapelli and ayou can be traced back with DNA-fingerprints to their exact position of origin along the chain of custody	• Genetic reference database • Project reports and publications	• Presence of microsatellites and SNP markers in the genome of each species showing sufficient variation and a fine scale spatial genetic pattern • Protocols on DNA extraction of processed timber are sufficient developed

Objectives



2.1.5 Development objective and impact indicators

To improve transparency and effective management of supply chains and increased domestic and international trade in legally produced tropical timber

=>See chapter 2.1.4 “Logical framework matrix”

2.1.6 Specific objective and outcome indicators

Development and implementation of species identification and timber tracking system with DNA fingerprints and stable isotopes for three commercial timber tree species in seven African countries
=>See chapter 2.1.4 “Logical framework matrix”

PART 3. DESCRIPTION OF PROJECT INTERVENTIONS

Outputs and activities

3.1.1 Outputs

Output 1: 20 tree species have been identified by wood anatomy and DNA barcode

Output 2: Genetic and stable isotopes reference data to control the country of origin for three important timber species have been created

Output 3: African timber producer countries equipped and their personal trained for timber species identification and control of origin

Output 4: Demonstration of control of chain of custody have been done with two tree species and stakeholders have been involved

3.1.2 Activities

For Output 1:

1. Sampling of wood probes and cambium or leaves from 200 individual's trees
2. Wood anatomical study of 20 tree species
3. DNA barcoding of 20 tree species
4. Blind testing of 50 samples from unknown origin belonging to 20 species based on wood anatomy and barcoding analysis

For Output 2:

1. Sampling of cambium or leaves from 4800 individuals trees and wood samples from 720 trees belonging to 3 species (240 locations, 20 samples for the genetics and 3 samples for the isotopes)
2. Optimisation of DNA extraction protocols for wood
3. Gene marker (chloroplast and nuclear microsatellites, SNPs) development for iroko
4. Gene marker (chloroplast and nuclear microsatellites, SNPs) development for sapelli
5. Gene marker (chloroplast and nuclear microsatellites, SNPs) development for ayou
6. DNA fingerprinting of 2000 iroko trees
7. DNA fingerprinting of 1400 sapelli trees
8. DNA fingerprinting of 1400 ayou trees
9. Blind testing of 60 samples from unknown origin belonging to 3 species based on DNA fingerprinting
10. Blind testing of 50 ayou samples from unknown origin based on DNA fingerprinting
11. Stable isotopes fingerprinting 300 iroko trees
12. Stable isotopes fingerprinting of 210 sapelli trees
13. Stable isotopes fingerprinting of 210 ayou trees
14. Blind testing of 60 samples from unknown origin belonging to 3 species based on stable isotopes fingerprinting

For Output 3:

1. Endowment of small DNA fingerprints laboratory equipments to African participants' countries
2. Training in skilled labs
3. Training in African labs
4. Supporting the development of the reference labs
5. Ring tests to setup same level of lab standards

For Output 4:

1. Sampling of cambium or leaves and wood probes of 1000 ayou trees
2. Sampling of cambium or leaves and wood probes of 1000 sapelli trees
3. DNA fingerprinting of 600 sapelli trees
4. DNA fingerprinting of 600 ayou trees
5. Training of local staff in Ghana
6. Stakeholder meetings

For project co-ordination

1. Executive agency coordination
2. Kick-off meeting
3. Steering committee and partners meetings

Implementation approaches and methods

The main outcome of the project should be an enforcement of laws and regulations on international timber trade and CITES protection. Thus important stakeholders for the implementation of the outcomes are governmental and forestry authorities in timber producer and timber consumer countries. In several cases these institutions are also representing the ITTO focal point of the country (e.g. the Forestry Commission in Ghana). During the pre-project phase representatives of these groups did participate at the two workshops in Hamburg and Yaoundé. And the project co-coordinator discussed already details of the project implementation with the forestry commission of Ghana in Kumasi in April 2011. We will keep them as much as possible involved in the project phase, which means common meetings, workshops and a permanent update on the project progress with electronic newsletters.

Besides the public authorities, responsible forestry companies and timber traders as well as NGOs (WWF, EIA etc.) have an interest to apply the new enforcement tools to proof legality of timber. We intend to integrate them as much as possible directly into the project. Thus forest companies are important partners in the sampling phase of plant material for the large scale reference data to check country of origin. Two pilot studies of the DNA based tree by tree chain of custody will be done with timber companies. Timber traders will be involved in the blind tests. In addition meetings and workshops are planned besides newsletters to keep these groups involved.

One important element of the capacity building in Africa is the creation of three genetic reference labs. Thus the aim is to enable the timber producer countries to do at least a part of the controls by themselves. For each of the three reference labs in Africa we will have one responsible lab in Europe that is focused on the support and training of the reference lab. This will be the vTI-FG for the reference lab in Kumasi (Ghana), the University of Brussels (Belgium) for the lab in Libreville (Gabon) and NERC Centre for Ecology and Hydrology (UK) for the lab in Nairobi (Kenya).

Work plan

Outputs and Activities	Responsible Party	Year 2012 Schedule (in months) 1 2 3 4 5 6 7 8 9 10 11 12	Year 2013 Schedule (in months) 1 2 3 4 5 6 7 8 9 10 11 12	Year 2014 Schedule (in months) 1 2 3 4 5 6 7 8 9 10 11 12
Output 1:20 tree species have been identified by wood anatomy and DNA barcode				
1.1. Sampling of wood probes and cambium or leaves from 200 individuals trees	TFT, GABT, vTI-FG			
1.2. Wood anatomical study of 20 tree species	vTI-HH			
1.3. DNA barcoding of 20 tree species	PGD			
1.4. Blind testing of 50 samples from unknown origin belonging to 20 species based on wood anatomy and barcoding analysis	WWF, vTI-HH, PGD			
Output 2: Genetic and stable isotopes reference data to control the country of origin for three important timber species have been created				
2.1. Sampling of cambium or leaves from 4800 individuals trees and wood samples from 720 trees belonging to 3 species (240 locations, 20 samples for the genetics and 3 samples for the isotopes)	TFT, GABT, vTI-FG			
2.2. Optimisation of DNA extraction protocols for wood	UA			
2.3. Gene marker (chloroplast and nuclear microsatellites, SNPs) development for iroko	ULB, GABT			
2.4. Gene marker (chloroplast and nuclear microsatellites, SNPs) development for sapelli	UA			
2.5. Gene marker (chloroplast and nuclear microsatellites, SNPs) development for ayou	UA			
2.6. DNA fingerprinting of 2000 iroko trees	ULB, GABT			
2.7. DNA fingerprinting of 1400 sapelli trees	vTI-FG			
2.8. DNA fingerprinting of 1400 ayou trees	UA			
2.9. Blind testing of 60 samples from unknown origin belonging to 3 species based on DNA fingerprinting	vTI-FG, NERC, BFW, UA, ULB			
2.10. Blind testing of 50 ayou samples from unknown origin based on DNA fingerprinting	WWF, UA			
2.11. Stable isotopes fingerprinting 300 iroko trees	TVU			
2.12. Stable isotopes fingerprinting of 210 sapelli trees	TVU			
2.13. Stable isotopes fingerprinting of 210 ayou trees	AIT			
2.14. Blind testing of 60 samples from unknown origin belonging to 3 species based on stable isotopes fingerprinting	WWF, TVU, FERA, AIT			

Outputs and Activities	Responsible Party	Year 2012 Schedule (in months)												Year 2013 Schedule (in months)												Year 2014 Schedule (in months)											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Output 3: African timber producer countries equipped and their personal trained for timber species identification and control of origin																																			
3.1. Endowment of small DNA fingerprints laboratory equipments to African participants countries	vTI-FG																									■	■	■	■	■	■	■	■	■	■	■	■
3.2. Training in skilled labs	vTI-FG, ULB, GABT, NERC																									■	■	■	■	■	■	■	■	■	■	■	■
3.3. Training in African labs	vTI-FG, ULB,							■	■	■	■	■	■				■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■
3.4. Supporting the development of the reference labs	vTI-FG, NERC																									■	■	■	■	■	■	■	■	■	■	■	■
3.5. Ring tests to setup same level of lab standards	vTI-FG, NERC																													■	■	■	■	■	■	■	■
Output 4: Demonstration of control of chain of custody have been done with two tree species and stakeholders have been involved																																			
4.1. Sampling of cambium or leaves and wood probes of 1000 ayou trees	UA				■	■	■	■	■	■	■	■	■																						
4.2. Sampling of cambium or leaves and wood probes of 1000 sapelli trees	vTI-FG													■	■	■	■	■	■																	
4.3. DNA fingerprinting of 500 sapelli trees	vTI-FG													■	■	■	■	■	■																	
4.4. DNA fingerprinting of 500 ayou trees	UA													■	■	■	■	■	■																	
4.5. Training of local staff in Ghana					■	■						■	■						■	■																
4.6. Stakeholder meetings	vTI, TFT										■	■									■	■												■	■		
Project co-ordination																																			
5.1. Executive agency coordination	vTI-FG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
5.2. Kick-off meeting	vTI-FG			■																															
5.3. Steering committee and partners meeting	vTI-FG						■												■												■					

Budget

3.1.3 Consolidated budget by component

Consolidated Yearly Project Budget
(featuring Input and Unit Costs)

	Budget Components	Input	Unit Costs	TOTAL	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
10	**Project Personnel**								
	11. Project Coordinator (20%)	36.0	$ 2,166.00	$ 77,976.00	$ 25,992.00	$ 25,992.00	$ 25,992.00	$ -	$ -
	12. Technical Project Coordinator	36.0	$ 6,899.00	$ 248,364.00	$ 82,788.00	$ 82,788.00	$ 82,788.00	$ -	$ -
	13. Scientists (Europe, Australia)	10.6	$ 7,220.00	$ 76,532.00	$ 25,992.00	$ 36,100.00	$ 14,440.00	$ -	$ -
	14. Technical Assistant (Europe, Australia)	22.0	$ 4,332.00	$ 95,304.00	$ 17,328.00	$ 51,984.00	$ 25,992.00	$ -	$ -
	15. Scientist (Africa)	36.0	$ 1,444.00	$ 51,984.00	$ -	$ -	$ 51,984.00	$ -	$ -
	16. Officer Administration (50%)	36.0	$ 1,805.00	$ 64,980.00	$ 21,660.00	$ 21,660.00	$ 21,660.00	$ -	$ -
	19. Component Total	**176.6**	**$23,866.00**	**$ 615,140.00**	**$ 173,760.00**	**$ 218,524.00**	**$ 222,856.00**	**$ -**	**$ -**
20	**Sub-contracts**								
	21. Sampling tree material per population	195.0	$ 1,603.69	$ 312,720.00	$ 167,190.00	$ 145,530.00	$ -	$ -	$ -
	22. Sampling tree material per individual sample	50.0	$ 144.00	$ 7,200.00	$ -	$ 7,200.00	$ -	$ -	$ -
	24. Lab work: Gene marker development per tree species	20.0	$ 1,155.00	$ 23,100.00	$ 5,775.00	$ 17,325.00	$ -	$ -	$ -
	25. Lab work: Genotyping per individual	2,110.0	$ 62.86	$ 132,640.00	$ -	$ 95,000.00	$ 37,640.00	$ -	$ -
	26. Lab work: Screening stable isotopes per individual	780.0	$ 116.00	$ 90,480.00	$ -	$ 55,680.00	$ 34,800.00	$ -	$ -
	27. Lab work: Wood Analysis => per individual	250.0	$ 116.00	$ 29,000.00	$ 5,800.00	$ 23,200.00	$ -	$ -	$ -
	28. Lab work: Ring Test	8.0	$ 1,400.00	$ 11,200.00	$ -	$ -	$ 11,200.00	$ -	$ -
	29. Component Total	**3,413.0**	**$ 4,597.55**	**$ 606,340.00**	**$ 178,765.00**	**$ 343,935.00**	**$ 83,640.00**	**$ -**	**$ -**
30	**Travel**								
	31. Daily Subsistence Allowance	232.0	$ 595.49	$ 138,154.00	$ 40,038.00	$ 21,748.00	$ 76,368.00	$ -	$ -
	32. International Travel	81.0	$ 2,166.00	$ 175,446.00	$ 71,478.00	$ 41,154.00	$ 62,814.00	$ -	$ -
	33. Local Transport Costs	66.0	$ 762.27	$ 50,310.00	$ 24,000.00	$ 13,155.00	$ 13,155.00	$ -	$ -
	39. Component Total	**379.0**	**$ 3,523.76**	**$ 363,910.00**	**$ 135,516.00**	**$ 76,057.00**	**$ 152,337.00**	**$ -**	**$ -**
40	**Capital Items**								
	44. Capital Equipment Genetic Lab	3.0	$21,660.00	$ 64,980.00	$ -	$ -	$ 64,980.00	$ -	$ -
	49. Component Total	**3.0**	**$21,660.00**	**$ 64,980.00**	**$ -**	**$ -**	**$ 64,980.00**	**$ -**	**$ -**
50	**Consumable Items**								
	53. Rent Conference facilities + Catering	8.0	$ 723.00	$ 5,784.00	$ 2,892.00	$ 1,446.00	$ 1,446.00	$ -	$ -
	54. Consumables lab work	1,411.0	$ 63.46	$ 89,539.00	$ 28,879.00	$ 21,900.00	$ 38,760.00	$ -	$ -
	59. Component Total	**1,419.0**	**$ 786.46**	**$ 95,323.00**	**$ 31,771.00**	**$ 23,346.00**	**$ 40,206.00**	**$ -**	**$ -**
60	**Miscellaneous**								
	61. Sundry	0.0	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	62. Auditing	0.0	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	63. Contingencies	0.0	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	69. Component Total	**0.0**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
70	**National Managment Costs**								
	71. Executing Agency Management Costs			$ -					
	72. Focal Point Monitoring			$ -					
	79. Component Total			**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
	SUBTOTAL			**$ 1,745,693.00**	**$ 519,812.00**	**$ 661,862.00**	**$ 564,019.00**	**$ -**	**$ -**
80	**Project Monitoring and Administration**								
	81. ITTO Monitoring and Review			$ 30,000.00	$ 10,000.00	$ 10,000.00	$ 10,000.00		
	82. ITTO midterm, final, ex-post Evaluation Costs			$ 15,000.00			$ 15,000.00		
	83. ITTO Programme Support Costs (8% on items 10 to 82 above)			$ 121,980.88	$ 37,772.80	$ 44,978.08	$ 39,230.00	$ -	$ -
	84. Donor Montoring Costs			$ -					
	89. Component Total			**$ 166,980.88**	**$ 47,772.80**	**$ 54,978.08**	**$ 64,230.00**	**$ -**	**$ -**
90	**Refund of Pre-Project Costs (Pre-project budget)**								
100	**GRAND TOTAL**			**$ 1,912,673.88**					

In annex 5 all details on the cost calculation (definition + number of units = input + Unit costs) for the different activities are given.

- Sub-contracts: The largest part of the total budget (955,845 US$) is reserved for sub contracts. This includes a large amount for sampling of tree material (leafs, cambium, wood samples) at 213 different locations in the seven African countries. The samples are essential to create the reference data for timber tracking and for the species identification. Most of the collaborative agencies doing the genetic and isotope lab work will be involved in the project as sub-contractors. As a basis for these contracts we estimates costs for genotyping and isotope inventory of an individual sample (tree) => see "Annex_budget.pdf"
- Project personnel: A big proportion of the personnel will be financed by other sources. From the budget requested by the ITTO the Technical Project Coordinators covers the largest part with an estimated budget of 248,364 US$ for 36 month. Minor budget components are scientists and technicians involved in the gene marker development and the genetic inventories. We also reserved a total budget of 51,984 US$ to co-finance scientists responsible for the three reference labs in Africa.
- Travel: Here we estimated a total budget of 416,572 US$. International and local traveling is planned in frame of the training for the three African reference labs (16 international flights), for three stakeholder meetings (25 international flights), the kick-off meeting (10 international flights), three steering committee and project partner meetings (18 international flights) and the project coordination (12 international flights). A big part of the travel budget is also reserved for per diems of the persons travelling and also for the African trainees during their education in Europe and Australia.
- Consumables: Most of the estimated 303,260 US$ are planned for consumables of the lab work in Europe, Africa and Australia.
- Capital items: The budget of 64,980 US$ is reserved to by smaller equipment (PCR machines, freezer etc..) for the three genetic reference labs in Africa.

Note: The below budget includes only the components that will be financed by the ITTO using the BMELV funds of USD 1,695,342 and the in kind contribution of the Excecuting Agency vTI of USD 220,932. All other components financed by other sources have been removed. That means the former Output 4 and all its activities "*Demonstration of control of chain of custody …..*" has been completely removed. This output was planned to be financed by a project submitted by Ghana to an ACP-FLEGT call. The proposal was rejected.

From the output 2 "*Genetic and stable isotope reference data….*" the following activities that were planned to be financed by a linkage grant from the Australian research council (ARC) were also removed:

1. Parts of the sampling
2. Optimization of DNA extraction protocols from wood
3. Gene marker development for sapelli
4. Gene marker development for ayou
5. DNA fingerprinting of 1400 ayou trees
6. Blind test for 50 ayou samples of unknown origin based on DNA fingerprinting

Since the ARC linkage grant was approved but with a strong reduction of the budget the Executing agency will negotiate with the University of Adelaide which components can still be coved.

3.1.4 ITTO budget by component

Yearly Project Budget By Source - ITTO

Annual Disbursements	Total	Year 1	Year 2	Year 3	Year 4	Year 5
Budget Components						
10. Project personnel	**$ 394,208.00**	$ 126,108.00	$ 118,888.00	$ 149,212.00	$ -	$ -
20. Sub-contracts	**$ 606,340.00**	$ 178,765.00	$ 343,935.00	$ 83,640.00	$ -	$ -
30. Duty travel	**$ 363,910.00**	$ 135,516.00	$ 76,057.00	$ 152,337.00	$ -	$ -
40. Capital items	**$ 64,980.00**	$ -	$ -	$ 64,980.00	$ -	$ -
50. Consumable items	**$ 95,323.00**	$ 31,771.00	$ 23,346.00	$ 40,206.00	$ -	$ -
60. Miscellaneous	**$ -**	$ -	$ -	$ -	$ -	$ -
Subtotal 1	**$ 1,524,761.00**	**$ 472,160.00**	**$ 562,226.00**	**$ 490,375.00**	**$ -**	**$ -**
80. ITTO Monitor. Evaluation. Costs						
81. Monitoring and Review Costs (effective estimation)	**$ 30,000.00**					
82. Evaluation Costs (effective estimation)	**$ 15,000.00**					
Subtotal 2	**$ 1,569,761.00**					
83. Program Support Costs (8% of Overall Budget)	**$ 125,580.88**					
84. Donor Monitoring Costs	**$ -**					
90. Refund of Pre-Project Costs	**$ -**					
ITTO TOTAL	**$ 1,695,341.88**					

3.1.5 Executing agency budget by component

Yearly Project Budget By Source - E. Agency/Host Government

Annual Disbursements	Total	Year 1	Year 2	Year 3	Year 4	Year 5
Budget Components						
10. Project personnel	**$ 220,932.00**	$ 47,652.00	$ 99,636.00	$ 73,644.00	$ -	$ -
20. Sub-contracts	**$ -**	$ -	$ -	$ -	$ -	$ -
30. Duty travel	**$ -**	$ -	$ -	$ -	$ -	$ -
40. Capital items	**$ -**	$ -	$ -	$ -	$ -	$ -
50. Consumable items	**$ -**	$ -	$ -	$ -	$ -	$ -
60. Miscellaneous	**$ -**	$ -	$ -	$ -	$ -	$ -
70. Executing Agency Management Costs	**$ -**	$ -	$ -	$ -	$ -	$ -
EXECUTING AGENCY/HOST GOVT. TOTAL	**$ 220,932.00**	**$ 47,652.00**	**$ 99,636.00**	**$ 73,644.00**	**$ -**	**$ -**

3.1.6 Activity and Component

Overall Project Budget By Activity and Component (in U.S. Dollars)

	BUDGET COMPONENTS																	
OUTPUTS / ACTIVITIES + Non-Activity Based Expenses	10. Project Personnel		20. Sub-Contracts		30. Duty Travel		40. Capital Items		50. Consumable Items		60. Miscella-neous		Year	GRAND TOTAL
Output 1: 20 tree species have been identified by wood anatomy and DNA barcode														
Activity 1.1: Sampling of wood probes and cambium	-		21,660.00	I	-		-		-		-		Y1	21,660.00
Activity 1.2: Wood anatomical study of 20 tree speci	-		23,200.00	I	-		-		-		-		Y1, Y2	23,200.00
Activity 1.3: DNA barcoding of 20 tree species	-		23,100.00	I	-		-		-		-		Y1, Y2	23,100.00
Activity 1.4: Blind testing of 50 samples from unkno	-		21,000.00	I	-		-		-		-		Y2	21,000.00
Subtotal 1	**-**		**88,960.00**	**I**	**-**		**-**		**-**		**-**			**88,960.00**
Output 2: Genetic and stable isotopes reference data to control the country of origin for three important timber species have been created														
Activity 2.1: Sampling of cambium or leaves from 48	-		291,060.00	I	-		-		-		-		Y1, Y2	291,060.00
Activity 2.2: Gene marker (chloroplast and nuclear n	43,320.00	I	-		-		-		28,879.00	I	-		Y1	72,199.00
Activity 2.3: DNA fingerprinting of 2000 iroko trees	-		116,000.00	I	-		-		-		-		Y2, Y3	116,000.00
Activity 2.4: DNA fingerprinting of 1400 sapelli trees	128,516.00	IE	-		-		-		30,660.00	I	-		Y2, Y3	159,176.00
Activity 2.5: Blind testing of 60 samples from unkno	-		8,640.00	I	-		-		-		-		Y3	8,640.00
Activity 2.6: Stable isotopes fingerprinting 300 iroko	-		34,800.00	I	-		-		-		-		Y2, Y3	34,800.00
Activity 2.7: Stable isotopes fingerprinting of 210 sa	-		24,360.00	I	-		-		-		-		Y2, Y3	24,360.00
Activity 2.8: Stable isotopes fingerprinting of 210 ay	-		24,360.00	I	-		-		-		-		Y2, Y3	24,360.00
Activity 2.9: Blind testing of 60 samples from unkno	-		6,960.00	I	-		-		-		-		Y3	6,960.00
Subtotal 2	**171,836.00**	**IE**	**506,180.00**	**I**	**-**		**-**		**59,539.00**	**I**	**-**			**737,555.00**
Output 3: African timber producer countries equipped and their personal trained for timber species identification and control of origin														
Activity 3.1: Endowment of small DNA fingerprints l	-		-		-		64,980.00	I	-		-		Y3	64,980.00
Activity 3.2: Training in skilled labs	-		-		75,660.00	I	-		30,000.00	I	-		Y3	105,660.00
Activity 3.3: Training in African labs	-		-		43,320.00	I	-		-		-		Y1, Y2, Y3	43,320.00
Activity 3.4: Supporting the development of the ref	51,984.00	I	-		-		-		-		-		Y3	51,984.00
Activity 3.5: Ring tests to setup same level of lab sta	-		11,200.00	I	-		-		-		-		Y3	11,200.00
Activity 3.6: Stakeholder meetings	-		-		81,320.00	I	-		-		-		Y1, Y2, Y3	81,320.00
Subtotal 3	**51,984.00**	**I**	**11,200.00**	**I**	**200,300.00**	**I**	**64,980.00**	**I**	**30,000.00**	**I**	**-**			**358,464.00**
Output 4: Project co-ordination														
Activity 4.1: Executive agency coordination	391,320.00	IE	-		56,368.00	I	-		-		-		Y1, Y2, Y3	447,688.00
Activity 4.2: Kick-off meeting	-		-		41,290.00	I	-		1,446.00	I	-		Y1	42,736.00
Activity 4.3: Steering committee and partners meeti	-		-		65,952.00	I	-		4,338.00	I	-		Y1, Y2, Y3	70,290.00
Subtotal 4	**391,320.00**	**IE**	**-**		**163,610.00**	**I**	**-**		**5,784.00**	**I**	**-**			**560,714.00**
Subtotal (ITTO)	**394,208.00**		**606,340.00**		**363,910.00**		**64,980.00**		**95,323.00**		**-**			**1,524,761.00**
Subtotal (E. Agency)	**220,932.00**		**-**		**-**		**-**		**-**		**-**			**220,932.00**
Subtotal (Others)	**-**		**-**		**-**		**-**		**-**		**-**			**-**
TOTAL	**615,140.00**		**606,340.00**		**363,910.00**		**64,980.00**		**95,323.00**		**-**			**1,745,693.00**
(I) - Contribution of the ITTO														
(E) - Contribution of the Executing Agency / Host Government														
(O) - Contribution from Other Sources														

The original plan was to work on seven target tree species. The budget estimated for that was 3.000.000 to 4.000.000 US$. The budget of 1,695,341 US $ given by the BMELV to the ITTO will be used to finance outputs 1 and 3, as well as 2/3 of output 2 and 1/3 of output 4. Two satellite projects covering complementary part of the ITTO work program have been submitted by the University of Adelaide and the vTI at the Australian Research Council (requested additional budget = 736,000 US$) and by the Ghana Forestry Commission to the ACP-FLEGT call (requested additional budget = 134,000 US$). The project submitted to the Australian Research Council will cover 1/3 of output 2 as well as 1/3 of output 4. The ACP-FLEGT proposal was planned to cover 1/3 of output 4. By September 2011 we got a positive evaluation for the Australian proposal and a negative decision for the ACP-FLEGT proposal. We are working on a resubmission of this proposal to another call.

We are in close discussions with the US government and the government of Austria who have signaled their interest to give additional funds via ITTO to the project. The plan for this is to work on an "enlargement" proposal for the next ITTO proposal deadline in January 2012. Basically the additional budget will be used to increase the number of studied species in output 1, 2 and 4 as well as the capacity building components of the project (output 3).

Note: The below budget includes only the components that will be financed by the ITTO using the BMELV funds of USD 1,695,342 and the in kind contribution of the Excecuting Agency vTI of USD 220,932. All other components financed by other sources have been removed. That means the former Output 4 and all its activities "*Demonstration of control of chain of custody …..*" has been completely removed. This output was planned to be financed by a project submitted by Ghana to an ACP-FLEGT call. The proposal was rejected.

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3. Gene marker development for sapelli
4. Gene marker development for ayou
5. DNA fingerprinting of 1400 ayou trees
6. Blind test for 50 ayou samples of unknown origin based on DNA fingerprinting

Since the ARC linkage grant was approved but with a strong reduction of the budget the Excecuting agency will negotiate with the University of Adelaide which components can still be coved.

Assumptions, risks, sustainability

3.1.7 Assumptions and risks

The sampling of the plant material for the three timber species to develop the reference data bases for origin assignment is a labor intensive and complicated work. It needs a good coordination between different teams in different countries and we need to get access to remote places. The sampling teams need to be well trained. => We will follow a two step sampling approach with a first genetic and isotopic screening of 2/3 of all samples followed by a first data analysis and the remaining 1/3 sampling according to the first results and identified high priority sampling regions. The sampling will be coordinated by the team of Prof. Dr. Jean Louis Doucet from the Gembloux Agro-Bio Tech (Belgium). This team has lots of experiences with sampling in West and Central Africa since many years.

The application of DNA markers to assign species and origin on processed timber assumes that the quality of extracted DNA is sufficient. To keep the risk of insufficient DNA quality as low as possible we will (a) put particular emphasis to further develop the DNA extraction protocols, and (b) work with DNA-markers that show genetic variation for short DNA fragments because these DNA markers are less sensitive to degraded DNA.

Assigning the geographic origin of timber assumes that the underlying spatial genetic pattern of DNA-markers and stable isotopes in the natural distribution area of the tree species is high strong enough. To be sure on that we will (a) develop a high number of DNA-markers for each of the three species using the new generation DNA sequencing approach and (b) make a combined application of DNA-markers + stable isotopes to assign the country of origin.

We have 5 different labs working on the genetics and 3 labs working on the stable isotopes + 3 genetic reference labs to be established in Africa => We need to make sure that the quality and precision of the scored data is comparable between the different labs. Thus we need to setup procedures to check the standards of the labs (e.g ring tests).

The forest authorities and logging companies in the different African countries might stay skeptical about the developed reinforcement tools. => We will try to involve them as much as possible in the project. Good results of the blind tests should convince them on the power of the enforcement tools.

The capacity and training component of the project is of great interest for the African countries. For the genetics there are three labs identified that will be further developed as reference labs but for the isotopes there is no lab facility present in the seven countries. This might case particular preconceptions against the application of stable isotopes because the work needs to be done completely outside of Africa. => We will look for additional funding to get at least one lab for the isotopes established in Africa. Or as an alternative, we will try to get a lab outside the 7 countries in Africa involved (e.g. in South-Africa).

The total budget of the project includes two satellite projects covering a complementary part of the ITTO work program. For this part proposals have been submitted by the University of Adelaide and the vTI at the Australian Research Council (requested additional budget = 736,000 US$) and by the Ghana Forestry Commission to the ACP-FLEGT call (requested additional budget = 134,000 US$). There is a risk that one or both of these proposals are not successful. In that case the amount of outputs (2 species instead if 3 in output 2, only parts of output 4 would be done) will be reduced. But this will not endanger the work of the other parts.

3.1.8 Sustainability

- ***Sustainability on political level***

The main outcome of the project will be an enforcement of laws and regulations on international timber trade and CITES protection. For this purpose genetic and isotopic tools will be developed and reference data bases to check the country of origin will be created. Many of the involved African countries have already signed voluntary partner agreement on FLEGT with the EU. Moreover starting in 2013 the new EU timber trade regulation will be applied. For timber imported to the USA the US Lacy act will be applied. Thus there is an elementary interest of both the timber producer and the timber consumer countries to maintain and further develop the tools that have been developed within this project.

- ***Sustainability on institutional level***

The genetic and isotopic reference data bases to control the country of origin of timber needs to be developed only once for each tree species. Thus this data keep valid also decades after the project ends because the underlying spatial genetic and spatial isotopic pattern does not change within decades. All project data will be integrated into the open access and centralized data base at Bioversity International. This will guarantee that the data will be maintained and available a long time. Bioversity International (http://www.bioversityinternational.org) is one of the centres of the Consultative Group on International Agricultural Research (CGIAR).

Within the lifetime of the project three genetic reference labs will be established in Ghana, Gabon and Kenya that enables the timber producer countries to do the DNA species control and the assignment of the country of origin. Missing equipment will be installed there and 10 persons will be trained in high level genetic labs in timber producer countries. A specific partnership between these “sister” labs in Europe and Australia and the three reference labs will be created. This partnership is expected to stay for long time. All western labs have already long term experiences to apply together with interested graduate and post graduate students from Africa for fellowships (like the DAAD in Germany). Thus there should be funds available to continue the training and to update the reference labs on new technologies even after the project finishes.

- ***Financial sustainability***

The responsible timber companies operating in Africa should have an elementary interest to proof the legal origin of their timber. This will be a market advantage to their competitors and it is known by the success of the FSC logo that consumers in Europe, USA and Australia are sensitive to this topic. Within the project particular efforts are undertaken to stimulate the private sector initiatives to establish DNA and isotopic audit systems on the market. For this reasons several private companies are directly involved in or linked to the project such as AgroIsolab TÜV Rheinland GmbH (http://www.agroisolab.de), Plant Genetic Diagnostics GmbH (http://www.plant-genetics.de) and Double Helix Tracking Technologies Pte Ltd (http://www.doublehelixtracking.com).

PART 4. IMPLEMENTATION ARRANGEMENTS

Organization structure and stakeholder involvement mechanisms
4.1.1. Executing agency and partners

The Institute of Forest Genetics at the Johann Heinrich von Thünen Institute (vTI-FG) in Germany will be the executive agency and the director of this Institute, Dr. Bernd Degen, will be the coordinator of the project.

13 collaborative agencies will support the vTI-FG (Table 4). Besides the vTI, 4 different genetic labs in Europe and Australia will share the genetic work of the project (UA, ULB, GABT, and PGD). The work of the isotopes will be done in Europe by three institutions (TVU, FERA, and AIT). As collaborative agencies in Africa the Forest Research Institutes of Ghana (FORIG) and Kenya (KEFRI) as well as the Institute de Recherche en Ecologie Tropicale – (IRED) in Gabon will participate in the project. At these three African Institutes already existing genetic labs will be further developed to serve as genetic reference labs. The further development of the macro- and microscopic wood anatomical tree identification will we done by the Institute of Wood Technology and Wood Biology of the vTI (vTI-HH). Under the coordination of Gembloux Agro-Bio Tech (GABT), The Forest Trust (TFT), the World Wild Fund for Nature (WWF) together with all African collaborative agencies and the forest administration of the seven involved African countries will do the sampling for the reference data bases and for the blind tests (Fig. 3). For the capabilities of the partners see section 2.1.1 “Institutional set-up and organizational issues” and the annex 1. The CV of the coordinator is given in annex 3.

Table 4: Project partners and their abbreviations

N°	Partners name	Code	Country
1	The Johann Heinrich von Thünen Institute	vTI	Germany
1.1	vTI - Forest Genetics	vTI-FG	
1.2	vTI - Wood Technology and Wood Biology	vTI-HH	
2	University of Adelaide	UA	Australia
3	Université Libre de Bruxelles	ULB	Belgium
4	Gembloux Agro-Bio Tech	GABT	Belgium
5	Plant Genetic Diagnostics GmbH	PGD	Germany
6	NERC Centre for Ecology and Hydrology	NERC	UK
7	TÜV Rheinland, AgroIsolab	TVU	Germany
8	The Food and Environment Research Agency	FERA	UK
9	Austrian Institute of Technology GmbH	AIT	Austria
10	The Forest Trust	TFT	Cameroun
11	World Wild Fund for Nature	WWF	Germany
12	Forestry Research Institute of Ghana	FORIG	Ghana
13	Institut de Recherche en Ecologie Tropicale	IRET	Gabon
14	Kenya Forestry Research Institute	KEFRI	Kenya

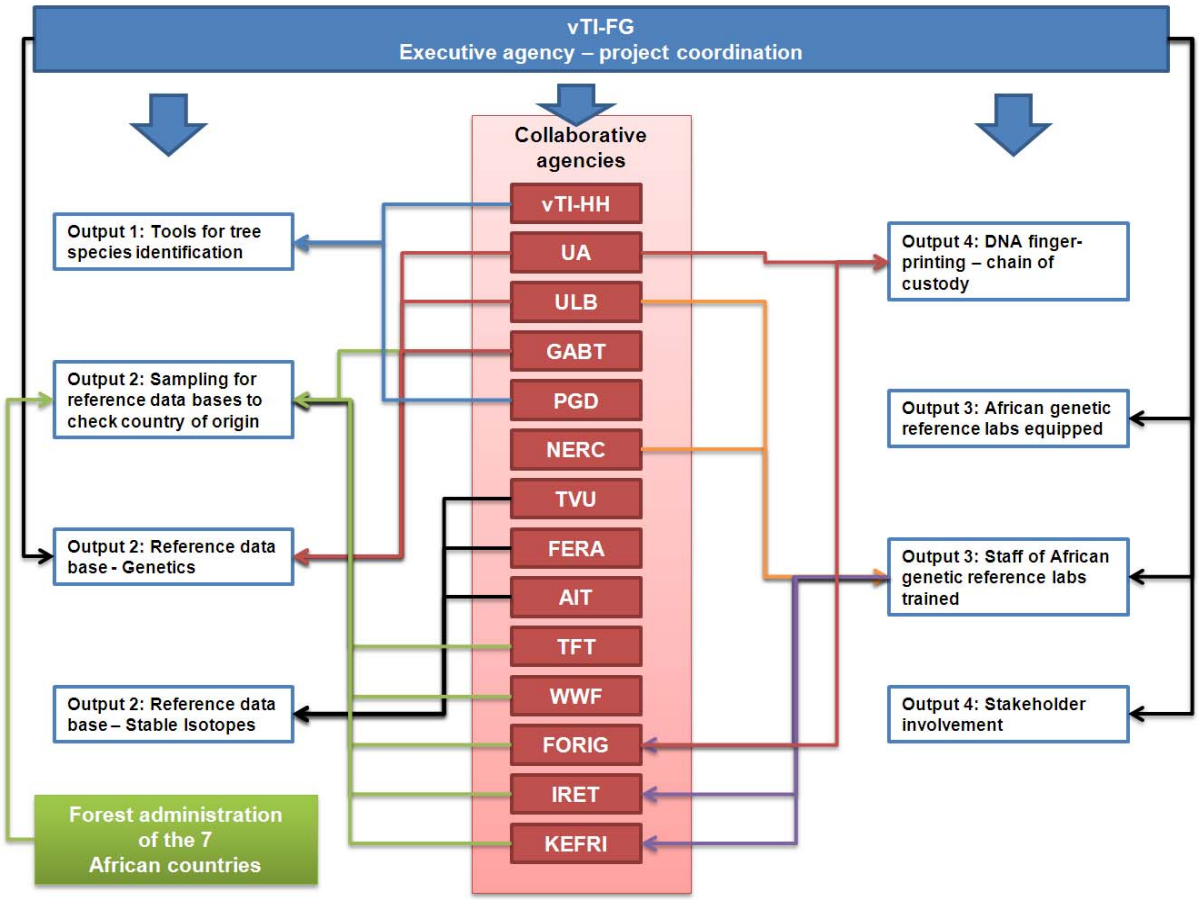

Fig. 3: Organizational chart of the ITTO project

4.1.2. Project management team

The project management team consists of the project coordinator from the vTI-FG, Dr. Bernd Degen, and a technical coordinator who will be appointed at the vTI-FG as a full time position for day-to-day project management. A project accountant at the vTI administration will support the project for the contractual and financial aspects.

4.1.3. Project steering committee

The executing agency will establish a project steering committee with the primary role to oversee project implementation, approve expenditures within the budget, review the activities that have been carried out, and to review and propose changes in budgets and activities. The project steering committee will monitor the overall strategic management of the project and ensure that it proceeds in a timely, efficient and effective manner in accordance with its logical framework matrix and work plan.

The project steering committee comprises:

- A representative of ITTO (project officer in Japan or African regional office of ITTO in Gabon)
- Representatives of the COMIFAC
- The scientific coordinator “Tree species identification and Geographic origin” at Bioversity International
- A representative of the donor = German Federal Ministry of Agriculture, Food and Consumer Protection (BMELV)
- The project coordinator (observer and secretary of the project steering committee)

The steering committee will have meetings in month 6, 18 and 30 of the project.

4.1.4. Stakeholder involvement mechanisms

As we did during the pre-project, all stakeholders from the timber sector will be involved in the project. Indeed, the consultation of different African and Europeans stakeholders done during the pre-project phases has yielded many good ideas summarized in the stakeholder analysis presented above. Additional information are available at the vTI homepage at

http://www.vti.bund.de/en/startseite/institutes/forest-genetics/test/itto-projekt.html.

Three stakeholders meetings (workshops) designed exclusively for participants not involved in the project are planned in the course of the project (at months 6, 18 and 30). They will be held at different locations (countries) in Africa to guarantee the participation of anyone interested. It is important to mention (a) that such workshops are not for stakeholders from the research sector, (b) that the language will be kept simple and easy to understand by everyone, and (c) that the discussion will focused mostly on the practical application/use of the projects results and how the tamper-proof methods can be integrated into the existing timber tracking systems. Stakeholders will also be kept informed via newsletters and an up to date project homepage.

Stakeholders such as forest concessionaires and African forest administrations are also directly involved in the sampling phase of the project activities: their field staff will be trained and will help for sampling.

African NGOs, international and development agencies working directly across Africa will supply timber samples for the blind tests. Thus their participation will demonstrate to the wider audience the utility of the new methods.

As for the demonstration of chain-of-custody:
SAMARTEX, the largest timber company of Ghana and Double Helix Tracking Technologies Pte Ltd, a private company specializing in the application of DNA to timber verification are integrated to the chain-of-custody demonstration project. Such participations from the private sector will help to advice on industry standard protocols.

The broad involvement of many stakeholders other than the research sector will keep them informed about and involved in the project implementation and will provide a platform for them to provide input into the project. Such steps are necessary to draw conclusions at the end of the project for the future practical application of the tamper-proof methods for timber tracking.

Reporting, review, monitoring and evaluation

The project inception report is planned at project month 3. Progress reports and technical reports will be prepared once a year. The ITTO monitoring visits to the executing agency will be combined with the meetings of the steering committee (thus at month 6, 18 and 30). The project management team will have meetings to monitor the progress of the project every 3 months. An internal participatory evaluation involving stakeholders will be conducted once a year. One representative of the collaborating agencies responsible for each of the main project outputs will participate in that. As all ITTO project we will enter the project progress into the ITTO online monitoring system.

All reports will follow the ITTO Manual on Project Monitoring, Review, Reporting and Evaluation and they will include the following aspects:

- Baseline survey/study
- Identification of key indicators
- Schedules and monitoring timetables and responsibility for monitoring
- Formats and protocols for data collection and analysis
- Ways of obtaining feedback on project implementation from stakeholders
- Staff and skills required to implement the monitoring and evaluation system, including training needs.

Dissemination and mainstreaming of project learning

4.1.1 Dissemination of project results

The project results will be distributed to all relevant multipliers, i.e. representatives from timber trade companies and federations (e.g. IFIA, FIB, FEBO, timber trade federations in EU Member States (e.g. GDHolz, FBCIB, VVNH, UK-TTF, LCB)), certification enterprises (e.g. FSC, PEFC, MTCC), auditing enterprises (e.g. SGS, SCS, Accreditation Services International, MTC), NGOs (e.g. WWF, FERN, Greenpeace, EIA) but also representatives from responsible authorities (e.g. forest, customs, trade, implementation of CITES) in FLEGT-partner countries, the EU, other G8 countries, other major timber trading countries (e.g. China, Viet Nam) and other interested countries as well as relevant international organizations (e.g. Bioversity International, ITTO, IUFRO, CIFOR, CITES, CBD).

Both means (workshop and publications) will use French and English language to reach a large international audience and especially an audience in the involved African countries.

It is planned to present the concept and results of the project at thematically suitable international conferences or workshops possibly taking place during the project period (e.g. Conferences and workshop in addressing FLEGT, CITES or the US Lacy Act).

Besides scientific publications, results will be published also in a practice oriented manner to reach a large audience. A leaflet of approximately 35 pages (English and French versions) summarizing the project results will be printed in 1.000 copies and distributed. The electronic version (pdf-format) will be posted online and distributed through relevant internet pages dealing with timber and logging issues such as www.illegal-logging.info, http://www.itto.or.jp/live/index.jsp, http://www.cbd.int/tech-transfer/info-database.shtml, http://www.cites.org/forum/forum.php).

Another suitable place for a paper addressing stakeholders is the FAO forest journal “Unasylva” (http://www.fao.org/forestry/unasylva/en/). Papers in Unasylva, which follow specific overall themes for every issue, are freely available and are published in three languages: English, French and Spanish.

At least three scientific publications are envisaged from the project. Paper will be submitted to journal such as Forest Ecology and Management.

4.1.2 Mainstreaming project learning

The presented regional project has a very clear link to national and international politics related to FLEGT and the US Lacy act and all national laws and regulations aiming to reduce illegal logging. With seven African countries involved it will be the largest project ever done in this field. Mainstream actor such as the Central African Forests Commission (COMIFAC) is member of the project steering committee. Some African governments taking part to the project have signed already FLEGT VPA agreements with the EU and the others are already engaged in negotiation processes. This project will strengthen the changes in policy and legislation, lead to the integration of the tamper-proof methods into the current timber tracking systems and to a better enforcement of forest laws in each country. The scientific coordinator “Tree species identification and Geographic origin” at Bioversity International whose job is to coordinate research, information management and development of international standards for use of DNA markers and stable isotopes to identify timber species and origin is also part of the steering committee. The genetic and isotope reference database generated by the project will be transferred to Bioversity International and will be made accessible to everyone.

PART 5. ANNEXES

Annex 1: Profiles of the excecuting and collaborating agencies

The description provided by each partner (Table 4) involved in the project implementation is presented here.

1. vTI (General)

The Johann Heinrich von Thünen Institute (vTI) is one of four German federal research institutes under the auspices of the German Federal Ministry of Food, Agriculture and Consumer Protection (BMELV). The vTI was created on January 1, 2008 from the German Federal Research Centre for Fisheries, the German Federal Research Centre for Forestry and Forest Products and part of the German Federal Agricultural Research Centre.

The vTI drafts scientific basics as decision-making helps for the policy of the German federal government and thus serves, with its application oriented and practice related research, the development of the society of tomorrow.

The vTI pursues interdisciplinary research in the following areas:

- Economics (micro and macroeconomics of agriculture, forestry, lumber, food and fish production),
- Technology,
- Material use of renewable natural resources,
- Climate,
- Biodiversity,
- Organic Farming.

For more details see: http://www.vti.bund.de/en/

The vTI will contribute to the project by two of its 15 Institutes:

1.1. Institute of Forest Genetics

It carries out research on genetics of indigenous and exotic tree and shrub species. The studies help to elaborate recommendations for national and international laws, conventions and strategies in the area of forest reproductive material, biological diversity, control of origin for timber and forest reproductive material, conservation of forest genetic resources, genetic engineering, adaptation to climate change and optimization of biomass production. Since ten years the Institutes is working in close co-operation with the University of Hamburg on the development and implementation of DNA-fingerprinting methods in different timber tracking projects in the tropics.

1.2. The Institute of Wood Technology and Wood Biology

Research carried out at the Institute of Wood Technology and Wood Biology is characterized by a broad approach along the complete wood value chain. This covers, besides others, formation of wood in trees, biological, chemical and physical properties of various wood species, its processing and machining as well as the technical, ecological and socio-economic aspects of wood utilization. Results generated by the Institute are expected to help decision makers in policy, bring forward consumer protection and support the wood industry. Special focus is given to the following topics:

Fields of activity:

- Wood structure, wood properties and wood quality
- Building with wood
- Platform chemicals from wood, fibre and composite materials
- Wood and environment

2. The University of Adelaide

The Australian Centre for Evolutionary Biology & Biodiversity (ACEBB) is a University of Adelaide designated research centre within the Environment Institute that brings together expertise from three key organizations: The University of Adelaide, the South Australian Museum and the Department for Environment and Natural Resources (DENR) Science Resource Centre, housing the State Herbarium and Biological Survey for South Australia. The **Mission** of the ACEBB is to be a leading national and international centre for research and training in evolutionary biology and biodiversity science, with an emphasis on fauna and flora of Australia

- Year of establishment -2000
- Fields of expertise - ACEBB is focusing its research effort around four key themes:

Species discovery and phylogenetics
Building on ACEBB's key strength in biodiversity discovery, taxonomy, systematic and phylogenetics, we are developing new molecular methods to understanding the evolutionary relationship species and their rapid identification, including DNA barcoding. In addition methods to incorporate evolutionary history into conservation assessments of species are being developed (e.g. phylogenetic diversity and endemism).

Evolutionary and landscape adaptation
Strengths in this area include; macroevolution, life history trait analysis, adaptational evolution, biogeographic history, phylogeography and recent landscape genetic and ecological changes due to contemporary pressures. Through this research ACEBB scientists are able to advance our understanding of evolutionary adaptations in Australian systems due to historical impacts (long term climatic change, geological change) and contemporary landscape influences (fragmentation, invasive species, climate change).

Biodiversity and ecosystem analysis and monitoring
This theme aims to improve our understanding of the dynamics of species and ecosystems and how they change over time in response to climate change, fragmentation and invasive species through analysis and modeling. Part of the research involves establishing large scale remote monitoring programs in terrestrial and marine environments to track the trajectory of biodiversity and ecosystems over time, and includes the development of novel monitoring techniques, such as DNA barcoding, environmental genomics, image capture and analysis and remote data feedback.

Biodiversity management and conservation decision-making
At the applied end of science, we are using the unique capabilities of ACEBB to combine genetic and adaptation understanding into biodiversity and ecosystem analysis and modeling for conservation decision-making. This is a new and expanding area of ACEBB's focus. Novel technical skills in environmental forensics and assessment that use DNA barcoding and phylogeographic data are also being developed (e.g. tracking illegal logging).

3. Université Libre de Bruxelles

The Université Libre de Bruxelles (www.ulb.ac.be), located in Brussels, Belgium, is a comprehensive university founded in 1834 and providing academic tuition in all disciplines and study cycles. It has ca. 24,000 students, 29% of whom come from abroad. As a private university, which is recognized and subsidized by the Belgian authorities, ULB receives government funding today to the tune of 58% of its overall budget (for more details about the University see: http://www.ulbruxelles.be/ulb/presentation/docs/UlbbrefENG.pdf).

The Evolutionary Biology and Ecology unit (http://ebe.ulb.ac.be/ebe/ebe-Welcome.html), one of the units of the Department of Organism Biology, Science Faculty, is composed of 7 senior researchers leading each a research group addressing questions about the ecology and evolution of various model organisms. The group of Olivier Hardy develops researches on plant population genetics and community diversity in tropical rainforests. It was established in 2004 and is now composed of 4 post-docs, 4 PhD students, 4 MSc students and a technician. The main projects funded so far are:

- "Genetic structure, gene flow and scale of local adaptation in tropical trees from Central Africa – What is the relative importance of selection and gene dispersal on genetic diversity organization?" 2007-2010, Fund for Scientific Research, Belgium.
- "African forest islands: model for a new approach of the dynamics of biodiversity structure", 2007-2010, National Agency for Research, France.

- "Organization of plant biodiversity across African rain forests at different levels of integration using genetic markers: phylogeography, DNA barcoding, and phylogenetic structure of communities" 2010-2011, Fund for Scientific Research, Belgium.
- "Population dynamics of trees and herbaceous species characteristic of central African rain forests in relation to past human and climate perturbations" 2010-2013, Fund for Scientific Research, Belgium.
- "What if the 6th extinction has already taken place? Causes and consequences of the last great environmental "crisis" 3000 years ago in forests of Atlantic equatorial Africa" 2010-2013, National Agency for Research, France.

Organizational chart:
Université Libre de Bruxelles -> 11 Faculties
Science Faculty -> 10 Departments
Department of Organism Biology -> 8 Research Units, 1 herbarium, 1 botanical garden, 1 zoological museum

Evolutionary Biology and Ecology unit -> 6 research groups leading scientific projects in the fields of chemical ecology, biodiversity and conservation, population genetics and phylogeography, evolution and social organization, systematic and phylogeny

Group "plant population genetics and community diversity in tropical rainforests" -> focus on intra-specific and inter-specific plant biodiversity in African rainforests

Infrastructure:
- Facilities for carrying out the work related to the proposal, such as laboratories, experimental facilities, training facilities, etc
- The Unit is equipped with a molecular genetics platform including a 48-capillaries sequencer. It has experienced into the development of molecular markers (e.g. microsatellites). The group has acquired a good expertise for conducting research in Central Africa and can count on a well developed network of local and international collaborators.

The research group of Olivier Hardy is mostly funded through national and international research projects. For the period 2009-2011, the annual budget for functional costs (mostly laboratory) averages ca. 100.000 Euros. The projects also cover salaries for 4 PhD students, 4 post-docs and a technician.

Personnel: The Unit is composed of 7 permanent researched (Dr or Pr), 8 post-docs, 14 PhD students, 3 technicians and 2 administrative personnel. Among these, 4 post-docs, 4 PhD students and one technician belong to the group of Olivier Hardy.

4. Gembloux Agro-Bio Tech / University of Liège

Fields of expertise
Gembloux Agro-Bio Tech (GxABT) (in the past Gembloux Agricultural University) is the oldest Belgian institution devoted to teaching and research in Agriculture and Biological engineering. Since October 1st 2009, GxABT is part of University of Liege in the "Academie Universitaire Wallonie-Europe". Its mission consists in teaching and researching the production and development of living resources to satisfy the food and non-food needs of population as well as their healthy living in a perspective of sustainable development. Four main fields of expertise are developed: (1) multifunctional management of forests and natural areas, (2) environmental techniques, (3) ecological intensification of agriculture productions, (4) processing industries: food and living organisms.

In terms of international cooperation GxABT is conducting co-operative projects with universities and research centres. It participates in developing projects in over 50 countries and is active in most international teaching and research-development networks. The faculty counts 30% of foreign students coming from Cameroon, Democratic Republic of Congo, Gabon, Senegal, Madagascar, Ivory Coast, Ecuador, Peru, Benin etc.

Gembloux Agro-Bio Tech / University of Liège will contribute to the project through the Unit of Forest and Nature Management (GxABT). The Unit of Forest and Nature Management, including the Laboratory of tropical and subtropical forestry provides specific training and services in the forestry filed regarding both temperate and tropical ecosystems through 4 research areas. Four main fields of expertise are developed:

- Silviculture and environment management: silviculture and forest ecosystems, ecological site analysis (soil, phytosociology, and ecological land classification), forest species ecology, and natural resources management.
- Forestry of tropical regions: ecology of tropical forest species, population genetics, participative developments, community forestry and agroforestry, game management, protected areas and non timber forest products. This second axis is implemented by the laboratory of tropical and subtropical forestry since 2003.
- Forest planning and geomatics: measurement of forest trees and stands, forest and multi-resources inventories, growth models of major species, multipurpose forest management, economy, logging, geographical information systems.
- Enhancement of forest resources value: use forest resources, relationships between silviculture and technological performance of wood, support to industry in primary and secondary processing of timber.

List of the main projects or studies conducted in the previous three years
Some of the main projects of the past three years:

1) Herbaceous and tree populations dynamics in dense forests of Central Africa in relation with past climatic and anthropogenic disturbances. Funded by "Fonds de la Recherche Fondamentale Collective" (FRFC / FNRS, Belgium)
2) Genetic structure, gene flow and scale of local adaptation in tropical trees from Central Africa. What is the relative importance of selection and gene dispersal on genetic diversity organization? Funded by "Fonds de la Recherche Fondamentale Collective" (FRFC / FNRS, Belgium)
3) Biodiversity of tropical forests explained through an integrated analysis of related determinist and stochastic predictors. Funded by Gembloux Agro-Bio Tech
4) How, why and where will tree species survive increasing pressure: providing diagnosis and decision-making tools to attenuate the effect of global change on biodiversity in the Congo Basin forests. Funded by European Union (ERANET-BIODIVERSA)
5) Partnerships for development of community forests. Funded by "Congo Basin Forest Fund" (via African Development Bank)
6) Development of community alternatives to illegal logging (Gabon and Cameroon). Funded by European Union.
7) Partnership with logging companies (Pallisco, Precious Woods, Wijma, SFID-Rougier, and SEFAC) to promote sustainable forest management. Funded by private companies.
8) Assessment of western lowland gorilla contribution to forest regeneration by seed dispersal in forests gaps. Funded by the Royal Zoological Society of Antwerp.

Facilities for carrying out the work related to the proposal, such as laboratories, experimental facilities, training facilities, etc
1) Since 2001, the Laboratory of tropical forestry has developed a partnership network in Central Africa (Gabon, Cameroon, Central Africa Republic and the "2 Congo") with research institutions and several logging companies aiming to provide tools and scientific bases for forest managers and by the way to conduct researches in these ecosystems. Thus, the Laboratory has a substantial logical support in the concerned countries.
2) Since 2004, the Laboratory was engaged in phylogeographic and phylogenetic studies of tropical plant species in collaboration with "Evolution Biologique et Ecologie" Unit of "Université Libre de Bruxelles" (cf. O. Hardy). Therefore, it contributes in collecting several thousand samples of plant material in West and Central African countries. At the same time, molecular markers are being developed by O. Hardy team, and we are now conducting studies on the research areas mentioned above.

Budget
Budget for the past 3 years for related projects is over 1 million €.

Personal
Total number of personnel in relevant fields, showing: 48
Number of personnel with postgraduate degrees: 5
Number of personnel with graduate degrees: 26
Number of middle-level technicians: 13
Number of administrative personnel: 4

5. Plant Genetic Diagnostics Ltd

PGD Ltd. is an independent, private enterprise offering services in plant DNA analysis, consulting and expertise, primarily specializing in genetic diagnostics in forestry and timber industry. The company provides population analyses and monitoring of forest genetic resources and the development of individual DNA-based information systems. Currently, activities focus on the design of molecular genetics tools for tracking the origin of biological resources and species identification methods (in particular forest reproductive material and timber).

***Selection of expertise**:*

2008: Genetic inventory of the endangered European black poplar (*Populus nigra*) and potential genetic introgression from the non-native poplar *Populus deltoides* in the natural preserve area `Elbetal´; service for `Landesforsten Mecklenburg-Vorpommern´

2009: Studies on the genetic integrity of the European oak species *Quercus robur, Q. petraea and Q. pubescens* with special focus on Brandenburg (Germany); service for the `Landeskompetenzzentrum Forst Eberswalde´

2010: Inventory of the genetic resources of the endangered European crab apple (*Malus sylvestris*) and its differentiation from cultivated apples (*M.* X *domestica*) using microsatellites markers; service for the `Nordwestdeutsche Forstliche Versuchsanstalt´, Hann. Münden, Germany

2010: Testing the applicability of new genetic assignment methods to control the origin of forest reproductive material. A case study in *Quercus robur* L.; service for the `Landesbetrieb Wald und Holz´ Northrhine Westphalia

2011: Timber species identification in the Meliaceae family using DNA barcoding; service for the German customs

2011: Genetic inventories of rare and endangered European tree species; service within the framework of a project coordinated by the BLE (Bundesanstalt für Landwirtschaft und Ernährung)

6. NERC Centre for Ecology and Hydrology

CEH is a research centre of the UK's Natural Environment Research Council, and is the UK's Centre of Excellence for research in the land and freshwater environmental sciences. CEH's research is aimed at improving understanding of the environment and the processes that support life on Earth. Activities focus in particular on the impacts of human activity on the world around us and in developing ready-to-use approaches for achieving environmental sustainability. CEH skills and expertise range from the smallest scale (the gene) to the largest scale (whole Earth systems) enabling integrated research across a wide range of scientific disciplines. Located at 4 sites across the UK, CEH's regional presence and extensive network of long-term monitoring and experimental field sites provide access to diverse ecosystems and support an internationally renowned research capacity. CEH is a major custodian of environmental data, including 20 million records of 12,000 species occurring across Britain and Ireland. CEH is engaged in major international networks, such as the Partnership for European Environmental Research (PEER) and leads European and global research efforts including the International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops. CEH's unique combination of cross-cutting scientific expertise, long-term environmental monitoring and state-of-the-art research infrastructure enable it to deliver practicable solutions so that future generations can benefit from a rich and healthy environment. At CEH Edinburgh, the Watt Section includes >30 staff working in a variety of disciplines including plant, invertebrate and freshwater ecology and ecological modeling. Staff shape and contribute to the Biodiversity, Water and Biogeochemistry Programmes on topics including the conservation and restoration of biodiversity and sustainable management of biodiversity, including species introductions. Watt Section staff is experienced leaders and participants in large-scale projects and have been involved in research on trees for many years.

List of the main projects or studies conducted in the previous years

PI – GAP (NERC 2009-2012, Genomics of Adaptation in European Pines, NE/H003959/1), GENEO-TROPECO (EC 2002-06, Sustainable Management of Neo-Tropical Tree Genetic Resources, contract value 1.47 million Euros and SEEDSOURCE (EC, 2005-10, Developing best practice for seed sourcing of planted and natural regeneration in the neotropics, contract value 1.9 million Euros); as Partner – OAKFLOW, ACACIAGUM and the EVOLTREE network of excellence focusing on the population genetic structure, evolution and genomics of European forest trees. As well as generating new, high-impact science (notably GENEO-TROPECO and SEEDSOURCE

7. TÜV Rheinland AgroIsolab GmbH

The commercial stable isotope laboratory TÜV Rheinland AgroIsolab GmbH (TR AgroIsolab) was founded 2002 as a spinoff of the German Research Center Jülich. Still yet the TR AgroIsolab GmbH is settled nearby that research center in Jülich (Germany).

Its working field is to trace back the origin of natural products as agricultural products using the stable isotopes of the "bioelements" as Hydrogen, Carbon, Nitrogen, Oxygen and Sulphur.

The TR AgroIsolab GmbH has a long term experience as the founder and senior advisor, Prof. Dr. Hilmar Förstel, has been working for more than 25 year on the field of the stable isotope research and was one of the advisors to establish a European isotopic database for wine.

Up to now the TR AgroIsolab GmbH is one of the few laboratories worldwide offering the analysis of all bio-elements.

Since 1998 the laboratory is DIN EN ISO9022 certified. The accreditation was successful finished in 2006 and the laboratory was reaccredited in the year 2010.

Under the lead of Dr. Markus Boner and Prof. Hilmar Förstel, two university graduated scientists and four laboratory technicians are working for TR AgroIsolab in the field of stable isotopes analytics.

The following projects were completed in the field of tracking back the origin of timber:

Title	Year	Funding
Check of the origin of wood using stable isotopes. Development the stable isotope method for an applicable application	2006-2007	Deutsche Bundesstiftung Umwelt DBU
Innovative timber tracking using genetic and isotopic fingerprints	2008-2010	European Union
Fingerprinting of timber: Combating illegal logging by using a combination of isotope method genetic analysis	2008-2011	Deutsche Bundesstiftung Umwelt DBU

The technical equipment includes 9 isotopic ratio mass spectrometers, which are applicable for hydrogen, oxygen and carbon isotope measurement out of timber. In the further projects new applications were developed to measure sulphur and nitrogen isotope, as well.

8. Austrian Institute of Technology GmbH

The AIT Austrian Institute of Technology takes a leading position in the Austrian innovation system and a key role in Europe as the RTO focusing on the key infrastructure topics of the future.

AIT provides research and technological development to realize basic innovations for the next generation of infrastructure related technologies in the fields of health & environment, energy, mobility and safety & security. These technological research areas are supplemented by the competence in foresight & policy development.

As a national and international network node at the interface of science and industry AIT enables innovation through its scientific-technological expertise, market experience, tight customer relationships and high quality research infrastructure.

- Year of establishment: 1956
- Fields of expertise: Health and Environment, Mobility, Intelligent Technologies, Foresight and Policy Development, Safety and Security

List of the main projects or studies conducted in the previous three years, indicating, if applicable, donor agencies (stable isotope working group in AIT):

- Origin of Tyrolean food stuff (Agrarmarketing Tirol, Austria and Research Center Laimburg, Italy)
- Isotope analysis of honey (AGES (Agentur für Gesundheit und Ernährungssicherheit))
- TRACE Project (Tracing to origin of food (EU-FP7 funded project))
- Backtracing migratory movements of waterfowl (IAEA (International Atomic Energy Agency))
- Differentiation of Styrian and non-Styrian food stuff (cucumber seed oil, horse bean, radish) (Styrian Chamber of Agriculture)

Infrastructure

- Three stable isotope laboratories with altogether 6 isotope ratio mass spectrometers and various kinds of peripheral instruments (elemental analyzer, thermal combustion elemental analyzer, GC-combustion, etc…), accompanied of preparation laboratories and

Budget*:*

- To the extent that is relevant to the project, the financial status and resources and the overall budgets for the previous three years:

Financial Data AIT Austrian Institute of Technology GmbH

	2008	**2009**	**2010**
Turnover (TEUR)	87.657	76.570	76.373
Export Share (in%)	28,5%	34,5%	46,94%
Number of staff (VZÄ)	582,8	449,6	409,0
Number of R&D staff (VZÄ)	461,4	340,1	304,0
R&D Expenditure (TEUR)	74.833	66.362	68.809
Cash Flow (TEUR)	14.006	-7.633	720

Personnel*:*

- Total number of personnel in relevant fields, showing (all numbers for the business unit carrying out the planned work):
  - number of personnel with postgraduate degrees: 15
  - number of personnel with graduate degrees: 5
  - number of middle-level technicians: 7
  - number of administrative personnel: 1

9. The Forest Trust

The Forest Trust (TFT – formerly Tropical Forest Trust) is a UK registered charity with over 90 staff working in 14 different countries in Africa, Asia, Europe, North America and South America. Since 1999, its core mission is to conserve through helping companies and communities in trading Forest Responsible Products (FRP). That is, to help ensure that forests are managed with a long-term perspective and have their value maximized to people, wildlife and the environment. TFT supports forest projects with expert advice and links them to responsible buyers committed to sourcing sustainable timber. Our expertise is based on a “Stepwise approach”.

TFT’s Objectives:

- To expand the area of impacted forests by independently certified as well-managed (not only, but mostly under the FSC System) from four million hectares to 100 million hectares over the next five years. The focus are tropical and temperate species, as well as other commodities that posses a strong forest footprint such as palm oil and soy— amongst today’s main drivers of deforestation;
- To assist communities in developing the necessary capacity to practice sustainable forestry, establish business enterprises and connect them to international sustainable forest-product markets;
- To cultivate and share expertise and experience internationally on implementing sustainable forest management.

Simply put, in our first 10 years we grew from two projects covering 45,000 hectares to 45 projects covering just over 4 million hectares. Another indicator of success is the continuous growing of our turnover that has increased from U$S 441,000 in 2002 to U$S 5,098,000 in 2009. TFT operations depend on financial support from two sources: business partners and donors, with business partners historically accounting for a slightly higher proportion. We have been working throughout the world by giving technical assistance to FSC Certification, capacity building and communication, Sustainable Forest Management (SFM), and market linkages. Mostly focused on helping to achieve certification, we have actually 4 projects with companies and communities in Indonesia, one in Malaysia, one in Laos, one in the Republic of Congo (Congo-Brazzaville) and another one in Brazil. We are also involved in larger initiatives that mix technical expertise and the research for “good governance” in the forestry sector as the TTAP (Timber Trade Action Plan), the RAFT (Responsible Asian Forestry and Trade), the Perhutani Certification Support Program and the Indonesian Natural Forests Programs. Add to that, in Central Africa, TFT has two more successful ongoing projects, the Centre for Social Excellence (CES) and “Biso na Biso” indigenous peoples’ voices radio station. Finally, in addition to TFT member commitments on excluding illegal timber from their supply chains, TFT manages the TTAP on behalf of European Commission and the European Timber Trade Federations (TTFs). With field teams operating in Asia, Africa and South America, TTAP is a fructuous partnership in between different sorts of organizations in response to the new regulatory framework of the EC Due diligence regulation and the US Lacey Act.

More information are found in our web site at www.tft-forests.org

10. World Wild Fund for Nature

WWF, the World Wide Fund for Nature, is the world's largest independent nature conservation organization. Founded as the World Wildlife Fund in Switzerland in 1961, WWF now consists of a global network of 27 national and five associate organizations plus 24 programme offices.

The German Environmental Protection Foundation 'WWF Deutschland' was established in 1963 and officially registered on 23. March 1973 as a non-profit, independent, non-partisan "Foundation for the Protection and Development of the Natural Environment", with headquarters located in Berlin, Germany.

Prime goal of WWF Germany is the conservation of the natural diversity of plants and animals as well as their natural habitats. Furthermore, WWF Germany strives to promote the sustainable use of renewable natural resources, to reduce environmental pollution and to limit wasteful consumption. WWF Germany focuses its conservation activities on three large-scale ecosystems: seawaters and coasts, interior wetlands, and forests. To achieve its environmental and conservation objectives, WWF Germany exerts influence on governments, commercial enterprises, trade and industry, and consumers. WWF injects its demands and suggestions into public bodies and national/international conferences on nature conservation and environmental protection. WWF cooperates with such global organizations as the World Conservation Union and the World Bank, as well as with various other nature conservation associations. In all of its projects, WWF Germany cooperates closely with WWF International and sister organizations all over the world.

WWF Germany is active in 21 international project regions – from nature conservation field work protecting tropical rain forests in Indonesia, to the conservation of the middle Elbe river, and to strategic lobbying in Brussels and Berlin. WWF Germany is member of: AGU (Arbeitsgemeinschaft für Umweltfragen/Working Group on Environment Matters), Bundesverband Deutscher Stiftungen (Federation of German Foundations), European Environmental Bureau EEB, EUROPARC, Forum Umwelt und Entwicklung (Forum Environment and Development), Forest Stewardship Council (FSC), Energy Vision, and several other initiatives or working groups.

Major focal points of national and international conservation commitments of WWF Germany are:

- intervention in international and national development, forestry, agricultural, fisheries, climate, water and energy policies (e.g., agro-environmental policy of the EU)
- promotion of sustainable use of natural resources, e.g. forestry and fishery practices according to the principles and criteria of the Forest Stewardship Council (FSC) and of the Marine Stewardship Council (MSC), as well as more sustainable and water efficient cotton production with the Better Cotton Initiative
- protection and restoration of important inland water bodies, as the rivers Mekong, Rhine, Elbe and Danube
- protection of the Central African and Southeast Asian rainforests, of the forests in the Russian Far East Amur Region and conservation in the Caucasus Ecoregion and associated wetlands
- environmental education and capacity building serving to empower individuals and institutions for making responsible decisions in the interest of nature conservation and of sustainable development – and for acting accordingly.

WWF Core Values

- Respect for human being and nature,
- Credibility,
- Independency,
- Responsibility

WWF Finance and Organization Set-Up

Paid staff at WWF Germany varies around 90 full-time positions. Altogether, about 140 persons are employed. WWF Germany is structured in 4 main departments, being Administration, Marketing, Politics & Communication and the Programmatic department.

11. Forestry Research Institute of Ghana

The mission of FORIG, Ghana's forestry research institute and the executing agency is to conduct use-focused research that generates scientific knowledge and appropriate technologies to enhance sustainable development, conservation, and efficient utilization of Ghana's forest resources. FORIG also disseminates forestry information for the improvement of social, economic and environmental well being of the people of Ghana. Completed and ongoing ITTO assisted projects are as found below.

Infrastructure of the Executing Agency FORIG

The Institute's permanent offices and laboratories are located at Fumesua, near Kumasi. It has research centers at Bobiri and Amantia both in the Moist, Semi-Deciduous Forest Zone, Benso in the Wet Evergreen Zone, and Bolgatanga in the Savanna Zone. There are also research stations at Subri, Afram, Pra-Anum Area, Main Northern Grassland and BiaTano and Asenanyo. FORIG has a number of laboratories that facilitates effective execution of her mandate as the main research institute in forestry and its related research in Ghana. The laboratories include, Biotechnology (very relevant to this project), Chemistry, Tree Improvement and Seed Technology, Wood anatomy, Wood Technology and Engineering, Pathology and Entomology. The laboratories of the Institute have a wide range of equipment for research and development. They include PCR Machines, Autoclave, Imaging system (UV chamber), Electrophoresis system, impregnation plants, seasoning kilns, wood testing machines, steam generators, microscopes, growth chamber and UV spectrophotometer etc. The Institute has a library facilities stocked with Forestry and Forestry Related books, catalogues and electronic documents including a CD-ROM workstation and The CD compiled by CAB International.

FORIG Personnel

Quantitative experts with post-graduation degrees	-	29
Quantitative experts with graduation degrees	-	9
Quantitative of middle level technicians	-	33
Quantitative of administrative personnel	-	21
Total number of FORIG personnel in forestry-related fields	**-**	**71**

Recently completed and ongoing ITTO assisted projects at FORIG

Project title	Project Number	Value	Collaborating institutions	Status
Capacity building for CDM forestry in the framework of SFM emphasizing community forests and poverty alleviation in Ghana	PD450/07 Rev.2 (F)	$665,882	Michigan Technological University, SAMARTEX and Farming Communities	Completed
Towards Sustainable Indigenous Mahogany Timber Production in Ghana: Phase II, Refining the Silvicultural "Tool Kit" and Practical Training for Industrial-Foresters and Community Farmers.	PD0 528/08 Rev.1 (F)	$784,834	FORIG, Michigan Tech, SAMARTEX, Log and Lumber Ltd	Operational
Processing and utilization of trees on farmlands and logging residues through collaboration with local communities		$550,000	FORIG.	Operational
Development of energy alternatives for the efficient utilization of wood processing residue: Co-Generation and Briquette production	PPD053/02 Rev. 1 (I)	$87,802		Completed

Investment promotion and enterprise development of the timber industry in Ghana	PPD 063/02	59.300	FORIG, GTA, GTMO, Forestry Commission, FAWAG	Completed
Fire-management and post-fire restoration with local community collaboration in Ghana	PD284/04 Rev. 2 (F)	731,925	IUCN, FORIG	Operational
Alternative mixed plantation systems and restoration strategies for conservation and sustainable production of native timber species in Ghana	PD256/03 Rev. 1 (F)	433,964	FORIG, Northern Arizona University	Completed
Towards sustainable timber production in Ghana: Stage 1. Improving shoot borer resistance and developing silvicultural systems to maximize mahogany plantation success.	PD105/01 Rev. 3 (F)	588,601	FORIG, Michigan Tech	Completed
Timber of tropical Africa Part1: Group7(1) within the PROTA programme	PD 264/04 Rev. 2 (M.I)	1,654,487	PROTA, Government of Ghana, Gabon, The Netherlands, France and UK	Operational

12. Institut de Recherche en Ecologie Tropicale

L'Institut de Recherche en Ecologie Tropicale, institut de recherche du Centre National de Recherche Scientifique et technologique (CENAREST), Gabon

- Année de création : 25 novembre 1985
- Domaine de spécialité : écologie des écosystèmes tropicaux, en particulier les forêts et autres végétations du Bassin du Congo.

Organigramme:

- Directeur : Dr. Alfred NGOMANDA, Chargé de Recherche (CAMES)
- Directeur Adjoint : Dr. Alain MOUGOUGOU, Attaché de Recherche
- Département d'Ecologie Végétale, Responsable : Dr. Nestor Laurier ENGONE OBIANG, Chargé de Recherche (CAMES)
- Département d'Ecologie Animale, Responsable : Dr. Rosalie NGOUA ép. MINTSA
- Station de Recherche d'IPASSA/Makokou ; Responsable : Dr. Joseph Vivien OKOUYI OKOUYI, Conservateur du Parc National de l'IVINDO
- Laboratoire de Biologie Moléculaire ; Responsable : Dr. Christiane ATTEKE, Maître-Assistant (CAMES)

Liste des principaux projets, ou études conduits au cours des trois années passées

- 2002 – 2006 : Projet de Valorisation des Aires Protégés, Composante II « Réhabilitation de la Station de Recherche IRET-IPASSA de Makokou » (PSVAP-Composante II, Makokou); Bailleur de fonds : Union Européenne (Fond Européen de Développement)
- Depuis 2007 : Projet ACP-FORENET « Establishing a FORest NETwork in ACP countries »; Bailleurs de fonds: Union Européenne et Sécrétariat Général du groupe des Pays d'Afrique, des Caraïbes et du Pacifique
- Depuis 2009 : Projet de Conservation de la Biodiversité en forêt tropicale à travers la coexistence durable entre l'Homme et l'Animal dans le Parc National de Moukalaba-Doudou (PROCOBHA); Partenariat avec l'Université de Kyoto (Japon) ; Bailleur de fonds : Agence Japonaise de Coopération International e (JICA)

Infrastructure:

- Les installations destinées à effectuer les travaux liés à la proposition, comme les laboratoires, les installations expérimentales, les installations pédagogiques, etc.
    - Laboratoires de Biologie Moléculaire et de Microbiologie de l'IRET à Libreville ;
    - Stations de Recherche :
        - Station de Recherche d'IPASSA à Makokou
        - Station de Recherche de l'IRET à Moukalaba-Doudou ;
        - Station d'Etude des Gorilles et des Chimpanzés à la Lopé, en partenariat avec le Centre International de Recherche Médicale de Franceville

Budget:

- Dans la mesure où il est pertinent au projet, le statut et les ressources financières et les budgets globaux des trois années précédentes
    - L'IRET est un établissement public à caractère scientifique, sous tutelle actuelle du CENAREST, mais autonome dans son fonctionnement ;
    - Budget au cours des dernières années
        - Financement de l'Etat (pour le fonctionnement): 50.000.000 FCFA par an ;
        - Financement du projet PSVAP-Composante II (Makokou), entre 2002 et 2006 : 1.500.000 euro, géré conjointement par l'IRET et le CIFOR
        - Financement du Projet ACP-FORENET, entre 2007 et 2012 : 900.000 euro (fonctionnement du projet) + 500.000 euro pour les activités de recherches= 1.400.000 euro. NB : ces fonds sont gérés conjointement et sous le contrôle du CIFOR qui est l'Agence d'exécution du Projet ACP-FORENET ;
        - Financement du Projet PROCOBHA, entre 2009 et 2014 : 3.250.000.000 FCFA, subdivisé comme suit :
            - Apport de la JICA : 2.500.000.000 FCFA
            - Contrepartie gabonaise : 750.000.000 FCFA

Personnel:

- Effectif total dans les domaines de compétence, montrant :
    - Effectif des employés titulaires de diplômes du troisième cycle de l'enseignement supérieur :
        - 3 chargés de Recherche CAMES
        - 8 chercheurs ayant un Doctorat ou PhD,
    - Effectif des employés titulaires de diplômes du deuxième cycle de l'enseignement supérieur :
        - DEA, Master : 20 ;
        - DESS, Ingénieurs (Agronomes) : 7
    - Effectif des techniciens qualifiés
        - Techniciens supérieures : 5
        - Agents technique de Recherche : 12
    - Effectif des employés d'administration: 5

13. KENYA Forestry Research Institute

Kenya Forestry Research Institute (KEFRI) was established in 1986 under both the Science and Technology Act Cap 250 Laws of Kenya, and the State Corporations Act (Cap 446).

Mandate: Conduct research in forestry and allied natural resources, Disseminate research findings, Co-operate with other research bodies within and outside Kenya, Establish partnerships with other organizations and institutions of higher learning in training on matters of forestry research.

Background

- KEFRI HEADQUARTERS is located on Naivasha road 25Km west of Nairobi City. The mission of KEFRI is to conduct research and provide information and technologies for sustainable development of forests and allied natural resources
- The Kenya Forestry Research Institute (KEFRI) was established in 1986 under both the Science and Technology Act Cap 250 Laws of Kenya, and the State Corporations Act (Cap 446).

***Expertise*:** KEFRI'S research and development programs are implemented through 7 programs namely;

(1) Farm Forestry Programme: Aims at diversifying and intensifying supply of forest products on farms, developing technology for improved productivity and market systems for tree products.
(2) Natural Forests Programme Undertakes research to guide conservation and management of natural forests. Focus is on participatory forest management, policy research, natural forest product valuation, restoration and rehabilitation of degraded forest areas and promotion of non-wood forests products for wider utilization
(3) Drylands Forestry Programme; Aims at effective and sustainable management of forest and woodland resources and developing rehabilitation technologies most suitable for drylands.
(4) Industrial Forest Plantations Programme; Aims at improving management and productivity of plantation forests to meet industrial wood demand. Focus is on supply of high quality propagation materials, reducing productivity losses caused by pest and disease incidences, human interference, fires or game damage. Also carries out is economic analysis of plantations while improving harvesting and utilization technologies.
(5) Tree Seed Programme; Ensures emphasizes the need for availability of high quality germplasm to support afforestation and forestation programmes. KEFRI is mandated to produce tree seed for all types of planting programmes and has also de-centralized seed distribution to make it easily accessible to farmers countrywide.
(6) Technology Dissemination and Service Programme; Provides supportive services to research programmes through information documentation and dissemination. Training programmes are conducted at national and international levels in the Social Forestry Training Centre. The programme manages a research cum commercial forest estate and a workshop for processing tree and wood products.
(7) Networks and Partnerships; Coordinates networks and partnerships with collaborating institutions within and outside the region

These programs are coordinated by National Programme Coordinators (NPCs) who oversee budgetary allocation and set targets for research projects. They monitor and evaluate projects in progress. Research and Development activities are implemented at 6 Regional Research Centres (Muguga - Highlands east of the Rift Valley, Londiani - Highlands west of the Rift Valley, Maseno - Lake Victoria Basin, Gede - Coastal zone, Kitui - Drylands and Karura Forest Products Research Centre with well developed sub-centres in Nyeri, Turbo, Kibwezi, and Kakamega.

There are various independently managed laboratories to support research namely; Biotechnology and molecular Biology, Photochemistry, Plant and soil analysis, Plant pathology, Entomology and Plant breeding laboratories. Mr Joseph Machua is the head of Biotechnology Laboratories

KEFRI carries out its activities in a clean, safe and secure environment under ISO 14001:2004 environmental management system (EMS) requirements. Consequently, KEFRI mainstream EMS in all of its activities

Organizational chart
Director > 2 Deputy Directors (Research and Development & Finance and Administration), 1 Manager, Corporate Affairs > 7 National Programme Coordinators > 6 Centre Directors > Scientists

List of the main projects conducted in the previous three years:

1. FOREAIM PROJECT: Bridging restoration and multi-functionality in degraded forest landscape of Eastern Africa and Indian Ocean Islands (EU-Funded 2005-20101)
2. ACACIA GUM PROJECT: Innovative Management of Acacia senegal Trees to Improve Land Productivity and Gum Arabic Production in Arid and Semi-Arid Sub-Saharan Africa (EU-Funded 2007-2011)
3. IFRI PROJECT: Development of forest policies, study and monitor the impact of institutional arrangements and incentives on forest resources in the East African region (FORD FOUNDATION 1997-Present).
4. NGARA PROJECT: Network for Natural Gums and Resins in Africa hosted at KEFRI (FAO 1997-Present)
5. SOCIAL FORESTRY PROJECT: African Regional Social Forestry Training (JICA Funded 1986-Present):
6. FORREMS NETWORK: Forest/Range Rehabilitation and Environmental Management Strengthening program HOSTED BY KEFRI (USAID Funded 2003-2006)

Infrastructure:

- KEFRI has a well equipped Biotechnology and Molecular Biology laboratory capable of DNA amplification, sequencing and genotyping, experimental facilities include automated growth chambers, glasshouses and field sites. There are training facilities, conference hall, Hostels and Catering unit.

Budget*:*

- The biotechnology equipments and other facilities and personnel available for this project have an estimated value of US$ 625,000. Requested support will be for field sampling and laboratory consumables
- BUDGETS (YEAR 2009-US$ 870,000), (YEAR 2010 - US$ 890,000) , (YEAR 2011 - US$ 900,000)

Personnel*:*

- Total number of personnel in relevant fields
    - number of personnel with postgraduate degrees = 100
    - number of personnel with graduate degrees = 15
    - number of middle-level technicians = 114
    - number of administrative personnel = 745

Annex 2:
Tasks and responsibilities of key experts provided by the executing agency

1. CV Project coordinator: Bernd Degen

Name: ***PD Dr. Bernd Degen***

Present Address:

Johann Heinrich von Thuenen-Institute
Federal Research Institute for Rural Areas, Forestry and Fisheries
Institute of Forest Genetics
Sieker Landstrasse 2
D-22927 Grosshansdorf
Germany
Tel.: +49-(0)4102-696-101
Fax.: +49-(0)4102-696-200
e-mail: bernd.degen@vti.bund.de
http://www.vti.bund.de/de/institute/fg/

Scientific Education:

1987-1993: Study of forestry at Georg-August-University Göttingen, Germany:

- Practical studies at higher forest service: in a district of the Kommunalverband Ruhrgebiet
- Graduate examination with master thesis in forest genetics: *'Vergleich der genetischen Struktur verschiedener Entwicklungsstadien innerhalb und zwischen drei Buchenbeständen aus Nordrhein- Westfalen' ('Comparison of the genetic structure within and between different ontogenetic stages of three beech stands in Nordrhein-Westfalen')*

04/1993 - 01/1996: Doctorate at faculty of forestry at Georg-August-University Göttingen with doctoral thesis in forest genetics: *'Modellgestützte Systemanalyse der Dynamik adaptiver Potentiale von Baumpopulationen'* (*'System analysis of the dynamics of adaptive potentials of tree populations by use of computer models')*

12/2005: Habilitation at the Department of Biology at the University of Hamburg about the theme: *"Studies on structure and dynamics of genetic variation of tree populations in temperate and tropical forests – contributions to a comparison", Venia legendi for the area Applied Botany*

Research Experiences:

04/1993 - 09/1996: Scientific co-worker at the Institute for Forest Genetics and Forest Tree Breeding of the Federal Research Centre for Forestry and Forest Products in Hamburg, Germany, with the project: *'Evaluation of the results of forest damage research (1982-1992) to explain complex cause-effect relationships by means of system analysis methods (Part: Ecological Genetics)'*

10/1996 – 09/1998: Scientific co-worker at the University of Hamburg with the project:
'Elaboration of recommendations for sustainable forestry to protect the genetic variation of forest trees and forest shrubs'
Working place: Institute for Forest Genetics and Forest Tree Breeding, Grosshansdorf

10/1998 – 05/2004: Scientist at INRA (Institut National de la Recherche Agronomique) in Kourou, French Guyana:
Research objectives:

- Evaluation of level and distribution of genetic diversity for a set of tropical tree species with contrasting life-history traits
- Modelling temporal and spatial dynamics of genetic structures of tropical tree species
- Simulation studies on the impact of logging and forest fragmentation on genetic diversity and tree species diversity

Since 06/2004: Director and Professor / Head of the Institute of Forest Genetics at the Johann Heinrich von Thuenen-Institute (vTI), Germany

Work in national and international research projects

Since 1996: ***European research projects***

- *„Biodiversity in Alpine Forest Ecosystems Analysis, Protection and Management“* - EU Programme: Agriculture and Fisheries. (modelling)
- *„Development, optimisation and validation of molecular tools for assessment of biodiversity in forest trees“* - EU Programme Biotechnology. (data analysis)
- *„Intra- and interspecific gene flow on oaks as mechanisms promoting genetic diversity and adaptive potentials“. EU FAIR* (genetic inventories, data analysis and modelling)
- *„Distribution of genetic diversity in tree species from the neotropics based on DNA fingerprinting assays: Implications for conservation, sustainable utilization and management“* - EU INCO Programme. (genetic inventories, data analysis and modelling)
- *„Sustainable management of neo-tropical tree genetic resources: Combining molecular and modelling methods to understand the structure and dynamics of gene diversity“* - EU INCO. (genetic inventories, data analysis and modelling)
- „*Developing best practice for seed sourcing of planted and natural regeneration in the neotropics“* - EU INCO. (data analysis and modelling)
- *„EVOLution of TREEs as drivers of terrestrial biodiversity“* (EU Network of excellence (technology transfer and modelling)
- *„Innovative timber tracking using genetic and isotopic fingerprints of two tree species in Cameron “*- Europe-Aid (genetic inventories)

10/1998-04/2004: ***French research projects:***

- Project ECOFOR (Le Groupement d'Intérêt Public Ecosystèmes Forestiers) / INRA: *„Regeneration of the tree species Dicorynia guianensis in French Guiana“.* (modelling)
- Project BRG (Bureau des Ressources Génétique): *„Direct and indirect estimation of gene flow of different tropical and temperate tree species“* (genetic inventories, data analysis and modelling)
- Project BRG: *„Linkage of models in the areas population genetics, population dynamics and forest growth – estimation of the impact of forest management on genetic diversity (*genetic inventories, data analysis and modelling)
- Project FCR (Fonds de Coopération Régionale): *„Scientific education and dissemination of research results for the sustainable management of forests in French Guiana and the Brazilian Amazon” (*co-ordination)

Since 2000: ***Other international research projects***

- International Tropical Timber Organization (ITTO): “Development and implementation of a species identification and timber tracking system in Africa with DNA fingerprints and stable isotopes” (co-ordination, genetic inventories)
- British- Brazilian project (DFID / EMBRAPA): “*DENDROGENE: Genetic conservation within managed forests in Amazonia”* (modelling, genetic inventories, data base development)
- US Mellon project: “*Comparison of population genetics and population dynamics of selected tree species in French Guiana, Panama, Brazil and Ecuador”* (genetic inventories, data analysis)

Since 2004: ***German research projects***

- *DFG "Genetic variation of green oak green oak leaf roller and its host by use of molecular gene markers- part II historical and present distribution Genetische Variation (project leader)*
- *DFG „Gene flow of Quercus robur on the landscape scale* (project leader)
- *BLE "Genetic monitoring of Prunus avium"* (co-ordination)
- *BLE "Developing methods for genetically sustainable seed harvest in seed stands"* (co-ordination)
- *DBU "Fingerprinting of timber – fighting against illegal logging" (genetic inventories)*

Lecture:

1996: *'Ecological Genetics'* University of Hamburg, Faculty of Zoology

1997/1998: *'Introduction in Forest Genetics'* Eidgenössische Technische Hochschule ETH Zürich Switzerland, Faculty of Forest Since

Since 1998: Presentations about forest genetics of tropical trees in frame of the students course "Forêts tropicales humides" of ENGREF (L'Ecole Nationale du Génie Rural des Eaux et des Forêt) in Kourou

Since 2006: Lectures and seminars at the Department of Biology at the University Hamburg

Award:

12/2000: Prize of "Thurn & Taxis" from the Technical University of Munich for the research in the field of biodiversity

Foreign languages:

English, French, Portuguese

Publications in international journals

Buschbom J., Yanbaev Y, **Degen B.** (2011): Efficient long-distance gene flow into an isolated relict oak stand. Journal of Heredity DOI: 10.1093/jhered/esr023

Jolivet C, **Degen B**. (2011): Spatial genetic structure in wild cherry (Prunus avium L.): II. Effect of density and clonal propagation on spatial genetic structure based on simulation studies. Tree Genetics & Genomes DOI: 10.1007/s11295-010-0354-2

Jolivet C, Holtken AM, Liesebach H, Steiner W, **Degen B**. (2011): Spatial genetic structure in wild cherry (Prunus avium L.): I. variation among natural populations of different density. Tree Genetics & Genomes 7: 271-283.

Hardesty B. D. , Dick C. W., James L. Hamrick J L. , **Degen B**., Hubbell S. P. Bermingham E. (2010): Geographic Influence on Genetic Structure in the Widespread Neotropical Tree Simarouba amara (Simaroubaceae), Tropical Plant Biology 3 : 28-39

Schroeder H, Yanbaev Y, **Degen B.** (2010): A Very Small and Isolated Population of the Green Oak Leaf Roller, Tortrix viridana L., with High Genetic Diversity-How Does This Work? Journal of Heredity 101: 780-783.

Bolte A, **Degen B.** (2010): Forest adaptation to climate change - options and limitations. Landbauforschung 60: 111-117.

Degen B, Holtken A, Rogge M. (2010): Use of DNA-Fingerprints to Control the Origin of Forest Reproductive Material. Silvae Genetica 59: 268-273.

Kramer K, **Degen B**, Buschbom J, Hickler T, Thuiller W, Sykes MT, de Winter W. (2010): Modelling exploration of the future of European beech (Fagus sylvatica L.) under climate change-Range, abundance, genetic diversity and adaptive response. Forest Ecology and Management 259: 2213-2222.

Scotti I, Calvo-Vialettes L, Scotti-Saintagne C, Citterio M, **Degen B**, Bonal D. (2010): Genetic variation for growth, morphological, and physiological traits in a wild population of the Neotropical shade tolerant rainforest tree Sextonia rubra (Mez) van der Werff (Lauraceae). Tree Genetics & Genomes 6: 319-329.

Carneiro FD**, Degen B**, Kanashiro M, de Lacerda AEB, Sebbenn AM. (2009): High levels of pollen dispersal detected through paternity analysis from a continuous Symphonia globulifera population in the Brazilian Amazon. Forest Ecology and Management 258: 1260-1266.

Schröder, H. and **Degen, B.,** (2008): Genetic structure of the green oak leaf roller (Tortrix viridana L.) and one of its hosts, Quercus robur L. Forest Ecology and Management 256: 1270-1279.

Redkina, N. N., Mullagulov, R. Y., Yanbaev, Y. A. and **Degen, B.**, (2008): Fine spatial structure of allozyme genotypes in isolated population of pedunculate oak Quercus robur L. (Fagaceae). Russian Journal of Genetics 44: 997-999.

Degen B., and Fladung M. (2008): Use of DNA-markers for tracing illegal logging. vTI Agriculture and Forestry Research 321: 6-14

Schröder, H. and **Degen, B.**, (2008): Spatial genetic structure in populations of the green oak leaf roller, Tortrix viridana L. (Lepidoptera, Tortricidae). European Journal of Forest Research 127: 447-453.

Sebbenn, A. M., **Degen, B.**, Azevedo, V. C. R.,Silva, M. B., De Lacerda A, A. E. B., Ciampi, A. Y., Kanashiro M., Caneiro, F. D., Thompson, I. and Loveless, M. D., (2008): Modelling the long-term impacts of selective logging on genetic diversity and demographic structure of four tropical tree species in the Amazon forest. Forest Ecology and Management 254: 335-349.

Sharma, K., **Degen, B**., von Wühlisch G.and Singh, N. B., (2007): An assessment of heterozygosity and fitness in Chir pine (Pinus roxburghii Sarg.) using isozymes. New Forests 34: 153-162.

Cloutier, D., Hardy, O.J., Caron, H., Ciampi, A.Y., **Degen, B.**, Kanashiro, M. and Schoen, D.J. (2007) Low Inbreeding and High Pollen Dispersal Distances in Populations of Two Amazonian Forest Tree Species. Biotropica 39 (3), 406–415.

Carneiro L, F. D. S., Sebbenn, A. M., Kanashiro, M. and **Degen, B.**, (2007): Low interannual variation of mating system and gene flow of *Symphonia globulifera* in the Brazilian Amazon. Biotropica 39: 628-636.

Gregorius, H. R., **Degen, B**. and König, A., (2007): Problems in the analysis of genetic differentiation among populations - A case study in Quercus robur. Silvae Genetica 56: 190-199.

Degen B., Blanc L., Caron H., Maggia L., Kremer A. and S. Gourlet-Fleury (2006) Impact of selective logging on genetic composition and demographic structure of four tropical tree species. Biological Conservation, 131, 386-401.

Hardy J.O., Maggia L. , Bandou E., Breyne P., Caron H., Chevallier M.-H., Doligez A., Dutech C., Kremer A., Latouche-Hallé C., Troispoux V., Veron V., **Degen B.** (2005) Fine-scale genetic structure and gene dispersal inferences in ten neotropical tree species. Molecular Ecology, Molecular Ecology, 15, 559–571.

Cavers, S., **Degen B.**, Caron H., Lemes M. , Margis R. ,Salgueiro F. and Lowe A. (2005) Optimal sampling strategy for estimation of spatial genetic structure in tree populations. Heredity, 95, 281-289.

Degen B., Bandou E. and Caron H. (2004). Limited pollen dispersal and biparental inbreeding in Symphonia globulifera in French Guiana. Heredity, 93, 585-591

Degen B. and Roubik D. (2004) Effects of animal pollination on pollen dispersal, self-pollination and effective population size of tropical trees: a simulation study. Biotropica 36 (2), 165-179.

Phillips P. D., I. S. Thompson, J. N. M. Silva, van Gardingen P. R. and **B. Degen**, (2004) Scaling up models of tree competition for tropical forest population genetics simulation. Ecological Modelling, 180, 419-434.

Phillips P.D., de Azevedo C.P., **Degen B**., van Gardingen P.R., Thompson I. S. and Silva J. N.M. (2004) An individual-based spatially explicit simulation model for strategic forest management planning in the eastern Amazon. Ecological Modelling 173, 335-354.

Kanashiro, M., Thompson I. S., Yared J. A. G., Loveless M. D., Coventry P., Martins-da-Silva R. C. V., **Degen B.**, and Amaral W. (2002): Improving conservation values of managed forests: the Dendrogene Project in the Brazilian Amazon. Unasylva 53 (209): 25-32.

König A., Burg K., Coart E., Csaikl U., Dam B. v., **Degen B.**, Petit R., Vries S. d. and Ziegenhagen B. (2002) Chloroplast DNA variation of oaks in western Central Europe. Forest Ecology and Management, 156, 147-166.

Sharma K., **Degen B.**, von Wühlisch G. and Singh N. B. (2002) Allozyme variation in eight natural populations of *Pinus roxburghii* Sarg. in India. Silvae Genetica 51, 2002, 246-253.

Degen B., Caron H., Bandou E., Maggia L., Chevallier M. H., Leveau A. and Kremer A (2001): Fine scale spatial genetic structure of eight tropical tree species as analysed by RAPDs. Heredity, 87, 497-507.

Degen B., Petit R. and Kremer A. (2001): SGS - Spatial Genetic Software: A computer program for analysis of spatial genetic and phenotypic structures of individuals and populations. Journal of Heredity, 92, 447-448.

Müller-Starck G., **Degen B.**, Hattemer H. et al. (2000): Genetic response of forest systems to changing environmental conditions - analysis and management. Forest Genetics, 7, 247-254.

Agundez D., **Degen B.**, von Wühlisch G. and Alia R. (1999): Multilocus analysis of *Pinus halepensis* Mill. from Spain: Genetic diversity and clinal variation. Silvae Genetica, 48, 173-178.

Degen B., Streiff R. and Ziegenhagen B. (1999): Comparative study of genetic variation and differentiation of two pedunculate oak (*Quercus robur*) stands using microsatellite and allozyme loci. Heredity, 83, 597-603.

Vendramin G. G., **Degen B.**, Petit R. J., Anzidei M., Madaghiele A. and Ziegenhagen B. (1999): High level of variation at *Abies alba* chloroplast microsatellite loci in Europe. Molecular Ecology, 8, 1117-1126.

Degen B. and Scholz F. (1998): Ecological genetics in forest ecosystems under stress as analysed by the simulation model ECO-GENE. Chemosphere, 36, 819-824.

Degen B. and Scholz F. (1998): Spatial genetic differentiation among populations of European beech (*Fagus sylvatica* L.) in Western Germany as identified by geostatistical analysis. Forest Genetics, 5, 191-199.

Degen B., Gregorius H.-R. and Scholz F. (1996): ECO-GENE, a model for simulation studies on the spatial and temporal dynamics of genetic structures of tree populations. Silvae Genetica, 45, 323-329.

Agundez D., **Degen B.**, von Wühlisch G. and Alia R. (1997): Genetic variation of Aleppo pine (*Pinus halepensis* Mill.) in Spain. Forest Genetics, 4, 201-209.

Degen B., Ziegenhagen B., Gillet E. and Scholz F. (1995): Computer-aided search for codominant markers in complex haploid DNA banding patterns - A case study in *Abies alba* MILL. Silvae Genetica, 44, 274-282.

Gregorius H.-R. and **Degen B.** (1994): Estimating the extent of natural selection in seedlings from different *Fagus sylvatica* (L.) populations: Application of new measures. Journal of Heredity, 85, 183-190.

2. Other involved project personnel at vTI

Name*:* Céline Jolivet
Age: 32 years
Gender: female
Since 2007: Research Scientist at vTI and University of Hamburg, Ecological Genetics of European and Tropical species
2003-2006: PhD studies, University of Zürich and Lausanne, Switzerland, Ecology and Evolution, "Population differentiation and its consequences in the white campion *Silene latifolia* (Caryophyllaceae): A functional analysis"
2002-2003: Five months traineeship at INRA Montpellier. Population genetics and diversity of Cacopsylla pruni (http://www.montpellier.inra.fr/)
1999-2002: MSc (Diplôme d'Etudes Approfondies) in agronomy (genetic resources and biological interactions): *Phylogeny of the genus Raphanus and biological control against Wild radish.* ENSAM and CSIRO Entomology European laboratories in Montpellier.
1999-2002: Study of agronomy at ENSAM (Ecole Nationale Supérieure Agronomique, Montpellier)

3. Key persons from the collaborating institutes

Title and name	Occupation	Institution	Expertise relevant for the project	Country
PD. Dr. Gerald Koch	Curator	vTI - Wood Technology and Wood Biology	Wood anatomy	Germany
Dr. Olivier Hardy	Prof.	Université Libre de Bruxelles	Genetic fingerprinting	Belgium
Dr. Andrew Lowe	Prof.	University of Adelaide	Gene markers development + Genetic fingerprinting	Australia
Dr. Jean Louis Doucet	Prof.	Gembloux Agro-Bio Tech	Sampling + Genetic fingerprinting	Belgium
Dr. Aki Höltken	Managing director	Plant Genetic Diagnostics GmbH	DNA barcoding	Germany
Dr. Stephen Cavers	Senior scientific officer	NERC Centre for Ecology and Hydrology	Training in DNA fingerprinting	UK
Dr. Marcus Boner	Researcher	TÜV Rheinland, AgroIsolab	Isotope fingerprinting	Germany
Dr. Simon Kelly	Researcher	The Food and Environment Research Agency		UK
Dr. Micha Horacek	Senior lecturer	Austrian Institute of Technology GmbH		Austria
MSc. Germain Yéné Yéné	Forest officer	The Forest Trust	Sampling + workshop in Africa	Cameroun
MSc. Johannes Zahnen	Forest department	World Wild Fund for Nature	Blind test	Germany
Dr. Emmanuel Opuni Frimpong	Researcher	Forestry Research Institute of Ghana	Genetic reference lab + Sampling	Ghana
PD. Dr. Alfred Ngomanda	Director	Institut de Recherche en Ecologie Tropicale		Gabon
Dr. David Odee	Researcher	Kenya Forestry Research Institute		Kenya

Annex 3:
Terms of reference of
personnel and consultants and sub- contracts funded by ITTO

Terms of reference for the scientific project coordinator at vTI-FG

- Setup the contracts between the executive agency and ITTO and between the executive agency and the collaborative agencies
- Supervise the implementation of the work plan and work
- Supervise the monitoring and evaluation of the project progress and budget development
- Organize the steering committee meeting, project meetings, ITTO monitoring visits
- Organize the project reports: project inception report, progress report and technical reports
- Obtain feedback on project implementation from stakeholders
- Organize the dissemination of project results

Terms of reference for the technical project coordinator at vTI-FG

A technical coordinator will be appointed at the vTI-FG as a full time position for day-to-day project management. He /she will work under the direct supervision of the scientific project coordinator to:

- implement of the work plan and work
- monitor the project progress and budget development => enter the information into the ITTO online monitoring system
- help to organize the steering committee meeting, project meetings, ITTO monitoring visits
- write the project reports: project inception report, progress report and technical reports
- keep in contact with the stakeholders
- work on the dissemination of project results
- create and update the project home page
- prepare and send out project homepage

Terms of reference for vTI-HH as collaborating agencies for species identification based on wood anatomy

- Macroscopic and microscopic analysis of 200 wood samples from 20 African tree species
- Integration of new data for computerized wood identification and update of the software and its manual
- Perform macroscopic and microscopic analysis of 50 wood samples in frame of the blind test

Terms of reference for PGD as collaborating agencies for species identification based on DNA barcoding

- sequencing of chloroplast DNA-fragments at barcoding target genes for 200 samples
- searching for SNPs (single nucleotide polymorphisms), fragment length differences in the chloroplast genome among 20 African species
- new primer design for short PCR amplification products (< 350 bp) that include the SNPs
- selection of restriction enzymes that distinguish between the SNP haplotypes
- verification of the DNA barcoding for 50 wood probes in frame of the blind test

Terms of reference for GABT, WWF, TFT, FORIG, IRET, KEFRI as collaborating agencies for sampling

- Sampling of cambium or leaves from 2000 iroko trees from 100 sampling locations (20 individuals sampled at each location) in the natural distribution area in the 7 African countries
- Sampling of cambium or leaves from 1400 sapelli trees from 70 sampling locations (20 individuals sampled at each location) in the natural distribution area in the 7 African countries
- Sampling of cambium or leaves from 1400 ayou trees from 70 sampling locations (20 individuals sampled at each location) in the natural distribution area in the 7 African countries
- Sampling of wood probes from 300 iroko trees from 100 sampling locations (3 individuals sampled at each location) in the natural distribution area in the 7 African countries
- Sampling of wood probes from 210 sapelli trees from 70 sampling locations (3 individuals sampled at each location) in the natural distribution area in the 7 African countries
- Sampling of cambium or leaves from 210 ayou trees from 70 sampling locations (20 individuals sampled at each location) in the natural distribution area in the 7 African countries
- Sampling of wood samples along the chain of custody for the blind tests

Terms of reference for UA, ULB, GABT and vTI-FG as agencies for the development of the genetic reference data base

- Optimization of DNA extraction protocols for wood (UA)
- Development of gene markers (chloroplast and nuclear microsatellites, SNPs) with high variation and clear spatial pattern for iroko (ULB, GABT)
- Development of gene markers (chloroplast and nuclear microsatellites, SNPs) with high variation and clear spatial pattern for sapelli (vTI-FG)
- Development of gene markers (chloroplast and nuclear microsatellites, SNPs) with high variation and clear spatial pattern for ayou (UA)
- DNA fingerprinting of 2000 iroko trees (ULB, GABT)
- DNA fingerprinting of 1400 sapelli trees (vTI-FG)
- DNA fingerprinting of 1400 ayou trees (UA)
- Blind testing of 60 samples from unknown origin belonging to iroko based on DNA fingerprinting (ULB, GABT)
- Blind testing of 60 samples from unknown origin belonging to sapelli based on DNA fingerprinting (vTI-FG)
- Blind testing of 50 ayou samples from unknown origin based on DNA fingerprinting (AU)

Terms of reference for TVU, FERA and AIT as collaborating agencies for the development of the stable isotope reference data base

- Stable isotopes (oxygen, hydrogen, nitrogen) fingerprinting 300 iroko trees (TVU)
- Stable isotopes (oxygen, hydrogen, nitrogen) fingerprinting of 210 sapelli trees (FERA)
- Stable isotopes fingerprinting (oxygen, hydrogen, nitrogen) of 210 ayou trees (AIT)
- Blind testing of 60 samples per species from unknown origin belonging to 3 species based on stable isotopes fingerprinting (TVU, FERA, AIT)

Terms of reference for UA and FORIG as collaborating agencies for pilot studies on the DNA-fingerprinting tree by tree along the chain of custody

- Sampling of cambium or leaves and wood probes of 1000 ayou trees (FORIG)
- Sampling of cambium or leaves and wood probes of 1000 sapelli trees (FORIG)
- DNA fingerprinting (chloroplast and nuclear microsatellites, SNPs) of 600 sapelli trees (UA)
- DNA fingerprinting (chloroplast and nuclear microsatellites, SNPs) of 600 ayou trees (UA)
- Training of local staff in Ghana (FORIG, UA)

Annex 4: Recommendations by ITTO's expert panel and resulting modifications

Assessment and recommendations by the Forty-second ITTO Panel	Changes in the revision
1) Project context: *…., the social, economic and environmental aspects could be enhanced with the inclusion of estimates of illegal logging, size of companies and the contribution of forest exports to GDP.*	We have added numbers on forest revenue and estimates of illegal logging in different countries in table 2.
2) Project rationale: *The problem analysis chart as presented was satisfactory although it was noted that the consequences were not solely caused by the key problem identified. The analysis could also be supported with a short descriptive text.*	We have redone the problem analysis chart showing a clearer relationship between the addressed key problem, its consequences and the causes. A short descriptive text has been added.
3) Refine the Logical Framework Matrix by adjusting some of the outputs in line with the main causes of the problem analysis and improving some of the indicators.	We have redefined and reduced the number of outputs to 4. All outputs have a clear link to the main causes of the problem now. The indicators have been improved.
4) Re-examine the outputs and activities to ensure their conformity with the main causes and subcauses presented in the problem analysis.	Have been done (see point 4).
5) *Present the project budget in accordance with the ITTO Manual for Project Formulation and some descriptions and explanations on the key components particularly sub-contracts and duty travel.*	Now the budget has been worked out with the ITTO Project Formulation Software Tool according to the guidelines given in the ITTO manual. A short description on key components has been added. All details on the description and costs of budget input units are given in the annex file "Annex_budget.pdf".
6) *Elaborate and strengthen the sub-section on stakeholder involvement mechanisms, focusing on stakeholders other than those in the research sector.*	Has been done.
7) *Strengthen the sub-section on dissemination and mainstreaming of project learning with emphasis on incorporating the private sector and stakeholders in the collaborating countries in Africa.*	The text has been clarified and completed on that.

Changes are marked yellow in the text.

Annex 5:

Details on the cost calculation in the budget (definition + number of units = input + Unit costs) for the different activities

	BUDGET COMPONENTS																					
OUTPUTS / ACTIVITIES + Non-Activity Based Expenses	**10. Project Personnel**		**20. Sub-Contracts**		**30. Duty Travel**		**40. Capital Items**		**50. Consumable Items**		**60. Miscella-neous**		**Year**	**GRAND TOTAL**
Output 1: 20 tree species have been identified by wood anatomy and DNA barcode														
Activity 1.1: Sampling of wood probes and cambium or l	-		21,660.00	I	-		-		-		-		Y1	21,660.00
Activity 1.2: Wood anatomical study of 20 tree species	-		23,200.00	I	-		-		-		-		Y1, Y2	23,200.00
Activity 1.3: DNA barcoding of 20 tree species	-		23,100.00	I	-		-		-		-		Y1, Y2	23,100.00
Activity 1.4: Blind testing of 50 samples from unknown o	-		21,000.00	I	-		-		-		-		Y2	21,000.00
Subtotal 1	**-**		**88,960.00**	**I**	**-**		**-**		**-**		**-**			**88,960.00**
Output 2: Genetic and stable isotopes reference data to control the country of origin for three important timber species have been created														
Activity 2.1: Sampling of cambium or leaves from 4800 i	-		291,060.00	I	-		-		-		-		Y1, Y2	291,060.00
Activity 2.2: Gene marker (chloroplast and nuclear micrc	43,320.00	I	-		-		-		28,879.00	I	-		Y1	72,199.00
Activity 2.3: DNA fingerprinting of 2000 iroko trees	-		116,000.00	I	-		-		-		-		Y2, Y3	116,000.00
Activity 2.4: DNA fingerprinting of 1400 sapelli trees	128,516.00	IE	-		-		-		30,660.00	I	-		Y2, Y3	159,176.00
Activity 2.5: Blind testing of 60 samples from unknown o	-		8,640.00	I	-		-		-		-		Y3	8,640.00
Activity 2.6: Stable isotopes fingerprinting 300 iroko trees	-		34,800.00	I	-		-		-		-		Y2, Y3	34,800.00
Activity 2.7: Stable isotopes fingerprinting of 210 sapelli	-		24,360.00	I	-		-		-		-		Y2, Y3	24,360.00
Activity 2.8: Stable isotopes fingerprinting of 210 ayou tr	-		24,360.00	I	-		-		-		-		Y2, Y3	24,360.00
Activity 2.9: Blind testing of 60 samples from unknown o	-		6,960.00	I	-		-		-		-		Y3	6,960.00
Subtotal 2	**171,836.00**	**IE**	**506,180.00**	**I**	**-**		**-**		**59,539.00**	**I**	**-**			**737,555.00**
Output 3: African timber producer countries equipped and their personal trained for timber species identification and control of origin														
Activity 3.1: Endowment of small DNA fingerprints labora	-		-		-		64,980.00	I	-		-		Y3	64,980.00
Activity 3.2: Training in skilled labs	-		-		75,660.00	I	-		30,000.00	I	-		Y3	105,660.00
Activity 3.3: Training in African labs	-		-		43,320.00	I	-		-		-		Y1, Y2, Y3	43,320.00
Activity 3.4: Supporting the development of the referenc	51,984.00	I	-		-		-		-		-		Y3	51,984.00
Activity 3.5: Ring tests to setup same level of lab standa	-		11,200.00	I	-		-		-		-		Y3	11,200.00
Activity 3.6: Stakeholder meetings	-		-		81,320.00	I	-		-		-		Y1, Y2, Y3	81,320.00
Subtotal 3	**51,984.00**	**I**	**11,200.00**	**I**	**200,300.00**	**I**	**64,980.00**	**I**	**30,000.00**	**I**	**-**			**358,464.00**
Output 4: Project co-ordination														
Activity 4.1: Executive agency coordination	391,320.00	IE	-		56,368.00	I	-		-		-		Y1, Y2, Y3	447,688.00
Activity 4.2: Kick-off meeting	-		-		41,290.00	I	-		1,446.00	I	-		Y1	42,736.00
Activity 4.3: Steering committee and partners meeting	-		-		65,952.00	I	-		4,338.00	I	-		Y1, Y2, Y3	70,290.00
Subtotal 4	**391,320.00**	**IE**	**-**		**163,610.00**	**I**	**-**		**5,784.00**	**I**	**-**			**560,714.00**
Subtotal (ITTO)	**394,208.00**		**606,340.00**		**363,910.00**		**64,980.00**		**95,323.00**		**-**			**1,524,761.00**
Subtotal (E. Agency)	**220,932.00**		**-**		**-**		**-**		**-**		**-**			**220,932.00**
Subtotal (Others)	**-**		**-**		**-**		**-**		**-**		**-**			**-**
TOTAL	**615,140.00**		**606,340.00**		**363,910.00**		**64,980.00**		**95,323.00**		**-**			**1,745,693.00**

(I) - Contribution of the ITTO

(E) - Contribution of the Executing Agency / Host Government

(O) - Contribution from Other Sources