



*Biodiversity In The Patent System:
A country study of biodiversity, genetic resources
and global patent activity for Chad*

Prepared for
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
October 2013

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Introduction

This report presents the results of analysis of patent activity for genetic resources and traditional knowledge from Chad. The report is divided into three sections:

Section 1 provides an overview of biodiversity in Chad based on information from the Global Biodiversity Information Facility and introduces the patent data.

Section 2 provides a general overview of patent activity for species known to occur in Chad in the period 1976-2010. This is followed by detailed analysis of patent documents that make reference to Chad and data based on species that are limited to distribution in Chad

The report was prepared using large scale text mining of patent data for species names and country names. This data was then combined with taxonomic information from the Global Biodiversity Information Facility. Additional patent research was conducted using the commercial Thomson Innovation database and processed using a variety of software tools.

Patents are an important indicator of investments in research and development directed to the development of commercial products. The aim of the report is to identify potential opportunities for economic development in support of conservation by identifying existing research and development involving species from Chad. The research did not investigate the terms and conditions under which patent applicants obtained the genetic resources and traditional knowledge disclosed in the patent document. Therefore the report does not consider the problem of biopiracy or misappropriation of genetic resources and traditional knowledge.

The research was initially limited to searches of patent data from the United States, the European Patent Office and the international Patent Cooperation Treaty in the period 1976-2010. Additional research was performed to identify and review all patent documents making reference to Chad published anywhere in the world between 1900 and 2013. As such the report provides a baseline for patent activity involving species from Chad as a basis for further research.

Our research focused primarily on documents that make reference to Chad and to cases where existing distribution data suggests Chad is a likely source for the species. This imposes two limitations on the research. First, we focus on identifying species that are a focus of existing research and development. However, the report does not seek to provide the complete global patent landscape for an individual species. Second, because we focused on identifying species from a country we did not search patent data for references to regions (i.e. Africa) or sub-regions (i.e. Southern Africa) in the patent data. To address this issue we deliberately highlight cases where a species is distributed in more than one African country.

This report is one in a series of reports on patent activity for species from African countries. The following observations are based on the research for the fifteen African country reports to date and form the main recommendations arising from the research.

Taxonomic Research:

1. There is a need to improve the availability of taxonomic information for each country. In the absence of taxonomic information it is not possible to identify genetic resources that are relevant to a particular country in patent data and any relevant opportunities for economic development. African countries could consider giving greater priority to taxonomic research and making taxonomic information available through GBIF.
2. Georeferencing of the coordinates for the locations of species is an important standard in modern biodiversity research. Georeferenced data can be used to identify where species have been recorded in a country and also where biodiversity research has been concentrated. In our view georeferencing is an under-utilised tool for identifying where species are located as a basis for engaging with indigenous and local communities to consider potential development opportunities. We recommend greater attention to georeferencing and its use for engagement with relevant indigenous and local communities.
3. Taxonomic research does not attract investment because it appears to be remote from economic considerations. In practice taxonomic information is vital to identifying opportunities for development that is supportive of the objectives of the Convention on Biological Diversity and its Nagoya Protocol.
4. Taxonomic information is also important for the capacity of countries to monitor compliance with the Nagoya Protocol by improving baseline data on the species within a country. Advancing knowledge and understanding of biodiversity and the traditional knowledge of indigenous and local communities has an important role to play in long term monitoring under the Nagoya Protocol.

The Patent System:

1. Patent documents are frequently unclear on the precise origin or source of genetic resources and associated traditional knowledge. In addition very limited information is available on the terms and conditions of acquisition of genetic resources and traditional knowledge. This could be improved through enhanced disclosure of origin measures as advanced by the African Group and discussed in greater detail elsewhere.¹
2. Species are commonly distributed in more than one country. It is important that African countries include requirements in access and benefit sharing agreements to clearly specify the source of genetic resources and associated traditional knowledge in any patent applications that may arise under the terms of an agreement. When combined with the enhanced disclosure measures noted above this would greatly improve capacity to monitor patent activity under the terms of the Nagoya Protocol.
3. One of the major issues that emerged in the research is the problem of essential incorporation of species into patent claims. Patent applicants frequently list very large numbers of species, or make reference to genera and families, with the purpose of incorporating all members of a genus or family into the scope of the patent claims. Typically these applications did not involve collection or use of many of the species that are listed. The aim of essential incorporation is to prevent others from using compounds, extracts or ingredients from these species in similar inventions or products. Where granted these patents are likely to have negative consequences for researchers and producers in African countries seeking to develop and export similar products from these species. In our view, patent claims for components of organisms should be limited to the species from which the compound or extract was isolated by the applicants and not extend to members of the genus or entire families. Furthermore,

¹ Oldham, P & Burton G (2010) *Defusing Disclosure in Patent Applications*. UNEP/CBD/COP/10/INF/44

in our view essential incorporation is anticompetitive and action should be considered to stop or severely restrict this practice.

4. In some cases patent activity may involve species that are vulnerable, endangered or CITES listed. In considering the possibilities for economic development identified in patent data it is also important to identify and assess the conservation status of the species concerned in order to support the objectives of the Convention on Biological Diversity.

Patents have frequently been viewed with suspicion within the biodiversity policy community as examples of the inequitable exploitation of resources from biodiversity rich developing countries. Our research demonstrates that patent data can also be turned to positive purposes to identify potential opportunities for economic development in Africa. We hope that this information will prove to be useful to African countries.

Chad

Area:

1,284,000 sq. km

Coastline:

Landlocked

Climate:

Tropical in south, desert in north.

Geography:

Broad, arid plains in centre, desert in north, mountains in northwest, lowlands in south. Lake Chad is the most significant water body in the Sahel.



Biodiversity in Chad and Patent Activity:

Data for biological diversity was obtained from the Global Biodiversity Information Facility (GBIF). GBIF is an international government-initiated resource that provides open access to the most comprehensive quantitative data of species across time and space presently available. All data is submitted by participating collections who share biodiversity information.

Using this resource we have obtained biodiversity records for species which occur in Chad. It should be noted that the usefulness of this data in determining the actual distribution of a given species is conditional to the comprehensiveness of the data submitted by GBIF participants. Therefore we would stress that the absence of records should not be interpreted as indicating an absence of a given species, and similarly that a recorded species that only appears from one country should not be regarded as evidence of endemism. All reasonable efforts in identifying endemic species were made from alternative sources during the compilation of this report.

GBIF presently records 1,350 resolved species names for Chad with 2,200 georeferenced coordinates for the occurrences of these species in Chad.

We identified a total of 135,622 documents containing species known to be distributed in Chad. Of these, 72 made some form of reference to Chad. These documents were manually reviewed in MAXQDA software to identify documents specifying a source or origin in Chad.

The 72 documents that made a specific reference to Chad contained one species. These documents were manually reviewed in MAXQDA data analysis software and through this process we were able to identify species where it was definitively stated that they had been collected, sampled or otherwise obtained from Chad.

In addition, using GBIF distribution data we identified four species where GBIF presently records distribution only in Chad. However these species did not appear in any patent documents where Chad was not explicitly mentioned. The idea behind this was to identify

cases where a species (based on available distribution data) was likely to have come from Chad and thus be regarded as a species of likely or potential significance for Chad.

Finally, we carried out an additional search across all global patent jurisdictions for any documents featuring the country name Chad published between 1900 and 2013. This search identified 1,808 raw documents with 69 documents containing species references which were manually reviewed using MAXQDA software.

Biodiversity and Distribution

Much of the data submitted to GBIF includes geographical coordinates indicating where the recorded species was located. A total of 2,200 coordinates were available for Chad. Using this data we are able to show the physical distribution across Chad of all GBIF recorded species. Plate 1 shows two maps: The left map shows plotted points, each indicating a GBIF record. The points are coloured to indicate the kingdom to which the species belongs. It should be noted that this geographical information is raw data as submitted to GBIF by participating recorders. It has not been cleaned to remove any human errors when inputting to the GBIF database (an example of such an error might be where a longitudinal coordinate has been recorded as a + rather than a -). The map to the right shows major settlements and roads. It also includes the location of two national parks - places expected to be of significance for biodiversity. A larger version of the distribution map can be found in the appendix of this country report.

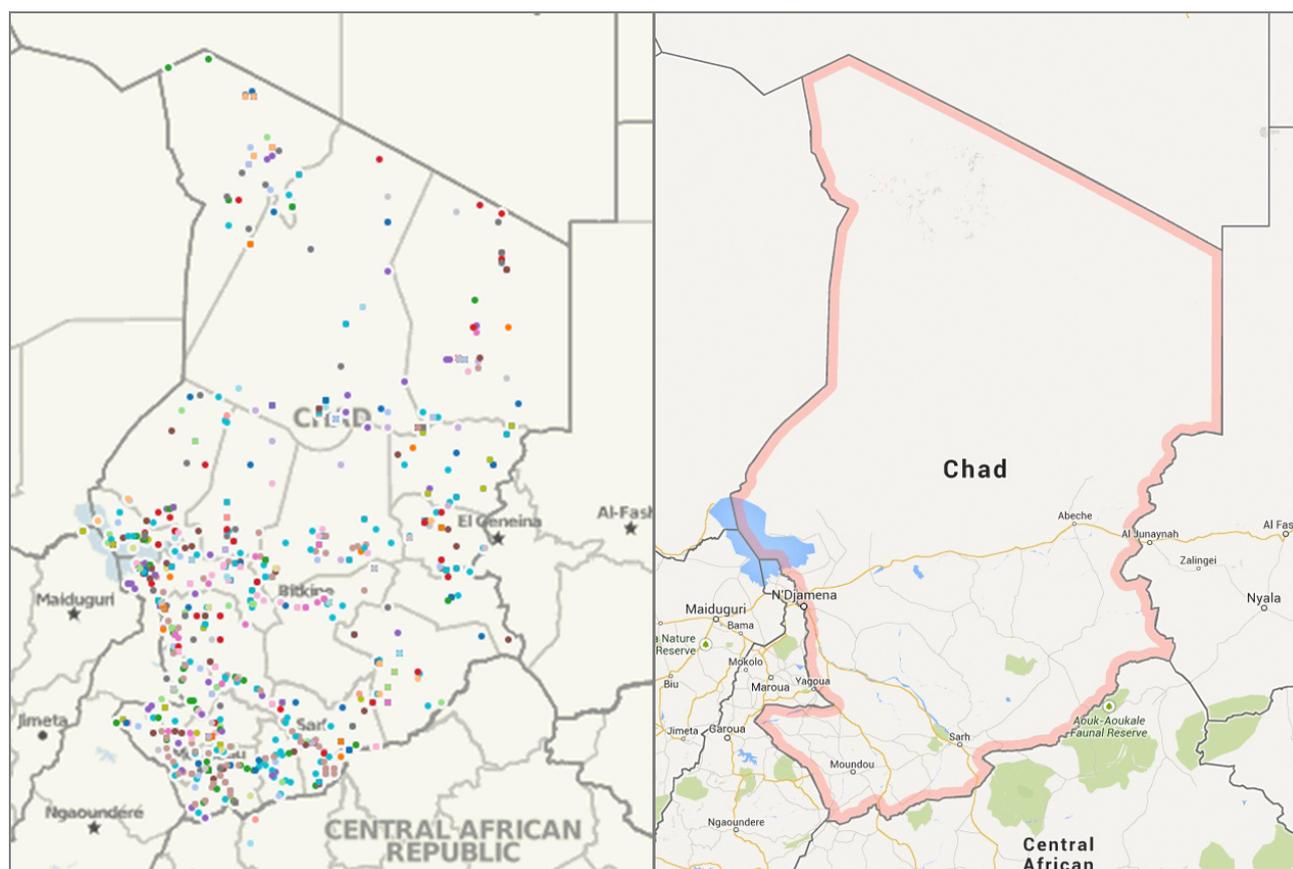


Plate1: Distribution of GBIF records from Chad (left) and major settlements and roads (right) (map courtesy of Google Maps). Each colour point represents a species record coloured by kingdom.

In comparing the two maps it can be seen that the distribution data is concentrated in the south and south west of the country. This is not surprising as this area of the country is the most densely populated and additionally, is the area of the country with with the climate most conducive to a more varied biodiversity - the central and northern parts of the country being dominated by arid grasslands and desert. A cluster of records can also be seen in the mountainous north west of the country. As is typical of distribution records across African countries the majority of records appear to be close to the capital city, N'Djamena, and can be seen to be concentrated in strings across the map which follow transportation networks. We would note that georeferencing of species data has an important role to play in facilitating the identification of where species are located in a country. While caution is required in the case of endangered species we would emphasise the wider importance of promoting georeferencing in enhancing knowledge and understanding of biodiversity in Chad.

GBIF presently records 1,434 species known to be present in Chad (this figure includes unresolved names, hence the increase in species from the number quoted above). This list is dominated by plants and animals which account for over 1,408 species as can be seen in Table 1. Other kingdoms are very poorly represented. This, along with the very low overall number of species suggests that recording and collection in Chad is very low.

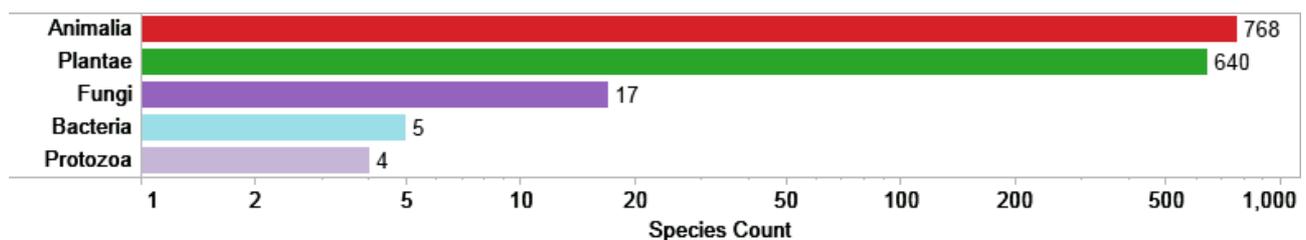


Table 1: Showing the number of species in Chad by kingdom using GBIF data.

Using global data it is possible to examine the wider distribution of Chadian species. Plate 2 shows where records exist across the globe for such species. Species that are found in two or more countries are referred to as 'cosmopolitan'. Each pie represents the number of species that are found in Chad in a particular kingdom. It can be seen that a substantial number of species have a very wide regional distribution throughout sub-Saharan Africa and that many species have global distribution, although it should be noted that some of these records may originate from research institutions or collections and therefore do not represent native or naturalised distribution, it is also likely that with such low levels of recording, that many of these species are crops.

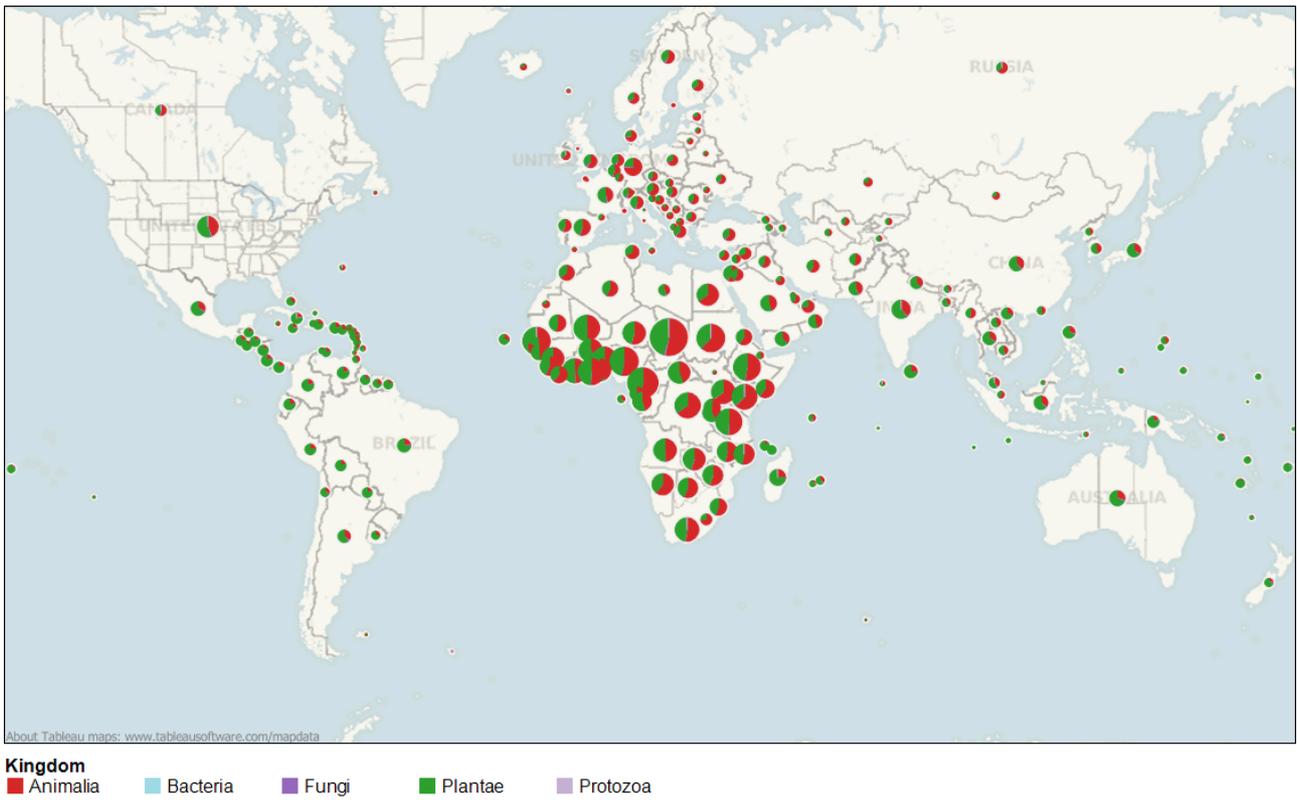


Plate 2: Global distribution of Chadian species shown by kingdom and the number of species recorded in GBIF.

Biodiversity in Chad in the Patent System

As of 2013 a total of 1,317 patent documents in the main patent jurisdictions (European Patent Office, the United States, and the Patent Cooperation Treaty) specifically mention Chad. This provides a general overview of references to Chad in the patent system across all areas of invention. Only a proportion of these documents will also refer to species collected in, or sourced from, Chad. In addition, patent applicants will make reference to species that originate from Chad but will not mention Chad as the source of genetic resources or traditional knowledge.

Our aim in this section is to provide a brief overview of patent activity for genetic resources of relevance to Chad. We focus on patent activity in the main patent jurisdictions in the period between 1976 and 2010. We then examine the results of research to identify genetic resources and traditional knowledge that originate from Chad. In approaching patent activity for genetic resources from Chad we focus on three categories of data.

1. Species that are known to be distributed in Chad but are also distributed elsewhere in the world. This provides an overview of global patent activity for genetic resources of relevance to Chad.
2. Species where a direct reference is made to the collection or origin of a species from Chad. This data is based on a review of patents that make reference to a species known to be distributed in the country and the country name.
3. Species where available distribution data suggests that a sample is likely to have originated from Chad. This data is known as Distribution data and refers to cases where GBIF presently only records a species as occurring in Chad and no other country. Because taxonomic information is incomplete this data provides a clue rather than proof that a species originated from Chad.

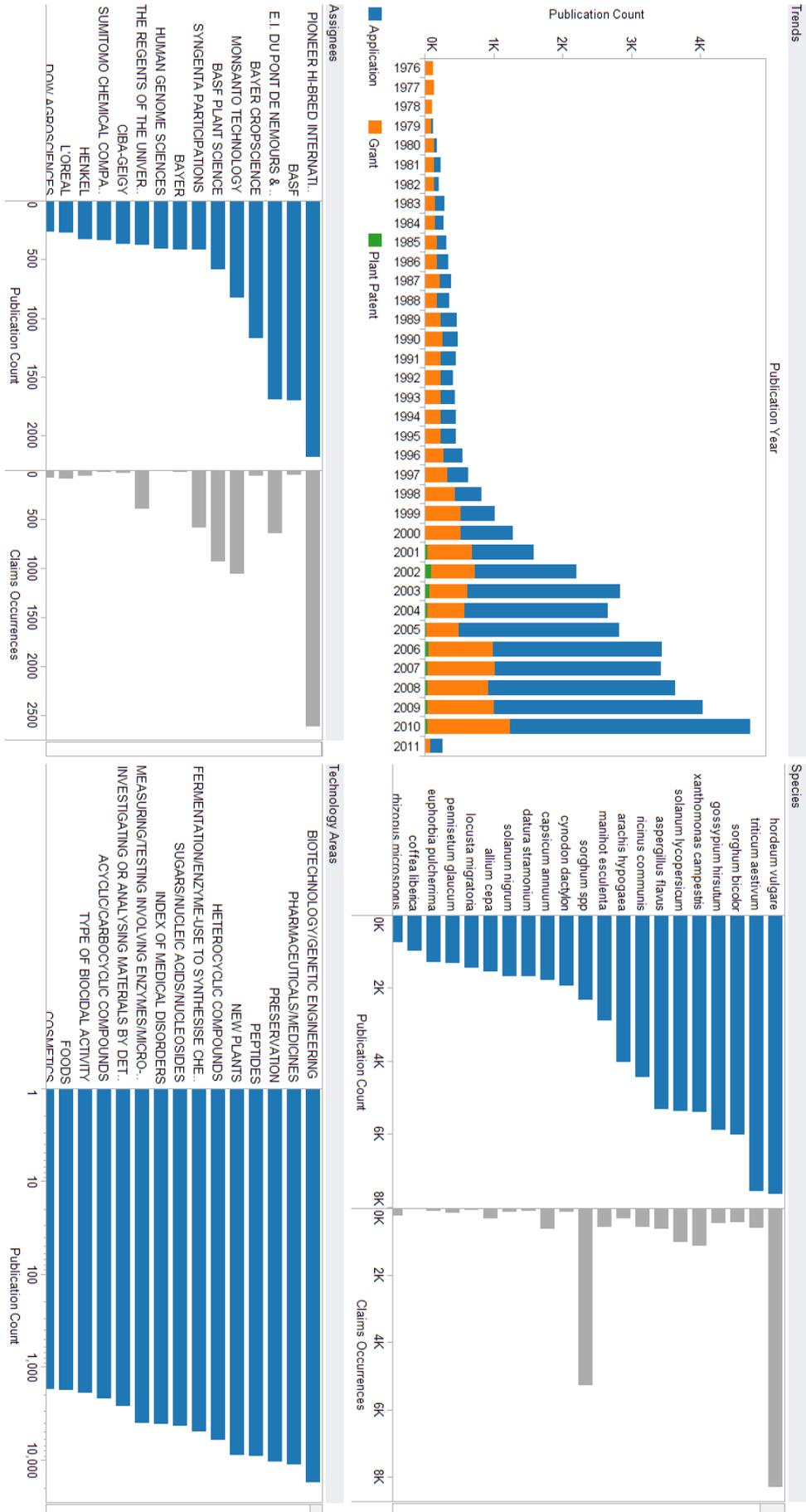
We begin our analysis with an overview of biodiversity that is known to occur in Chad in the patent system and then turn to data on species originating from Chad.

Chad shares a significant proportion of its known biodiversity with other countries in Africa and around the world. Plate 3 provides an overview of patent activity for species that are known to occur in Chad and other countries around the world. This overview provides information on trends in applications and grants, the top species appearing in patents that are known to occur in Chad, top applicants or assignees and technology areas.

In total we identified approximately 590 species names in patent data from the major jurisdictions that are known to occur in Chad. When model organisms including crops such as *Zea mays* (maize) and *Homo sapiens* are excluded this falls to 511 species names and 357 accepted scientific names.² This data is relevant for Chad because it demonstrates that researchers and companies are conducting research and development on species that are known to occur in Chad. As Plate 3 makes clear, research and development is taking place across a range of technology sectors and is targeted to a variety of markets.

² The 357 figure excludes common model organisms such as *E. coli*, *Arabidopsis thaliana*, *Bacillus subtilis* and *Zea mays* (maize) that are globally distributed and are used as research tools in biotechnology. These species appear prominently in patent data for all almost countries and are therefore excluded.

Plate 3: Overview of patent activity featuring species occurring in Chad.



The top species of relevance to Chad in global patent data are dominated by cosmopolitan crops and crop pests. In total we identified 204 plant names in global data of relevance to Chad with crops represented by species including peanut (*Arachis hypogaea*), cereals (*Sorghum spp*, *Triticum aestivum*, *Pennisetum glaucum* and *Hordeum vulgare*), pepper (*Capsicum annuum*), castor oil plant (*Ricinus communis*), tomato (*Solanum lycopersicum*), cassava (*Manihot esculenta*), onion (*Allium cepa*), cotton (*Gossypium barbadense*), apple guava (*Psidium guajava*), Liberian coffee (*Coffea liberica*) and tobacco (*Nicotiana tabacum*). Other species include the plant pathogens *Xanthomonas campestris* and *Aspergillus flavus*, the nightshades *Datura stramonium* and *Solanum nigrum*, which have some traditional medical uses and *Cynodon dactylon*, a species of grass widely cultivated in tropical regions across the world. The migratory locust (*Locusta migratoria*) is a crop pest capable of causing major economic impact. *Euphorbia pulcherrima*, known as Poinsettia, is a globally cultivated horticultural plant.

The assignees in the overall data for species of relevance to Chad are, likewise, dominated by companies working in crop science and agriculture. Companies such as BASF and Bayer in areas such as biocides/insecticides, agriculture (e.g. Du Pont and Pioneer Hi-Bred International). More detailed analysis of technology areas revealed pharmaceutical companies such as Ciba Geigy. Also companies which develop new crops such as Syngenta and Monsanto feature prominently. Other areas of speciality include chemical products, both domestic and industrial (Henkel) and cosmetics (L'Oreal). This makes clear that the agricultural industries are most relevant to Chad, but that other industries are active in areas and markets which utilise species found in Chadian biodiversity. To gain a more focused view of activity we now turn to the results of research to identify organisms appearing in patents that were directly collected in Chad or where distribution data suggests that Chad is the likely source.

Species from Chad in Patent Data:

We identified no species of organism that was directly sourced from, or potentially originated from Chad based on distribution data.

In considering this result we would note that while no species have been identified as originating from Chad, cosmopolitan species such as *Acacia seyal* and *Juglans regia* which are native to several African countries, may hold significant potential for collaboration in economic development and conservation.

Chad has a limited portfolio of species that appear in patents. It has been seen that these are dominated by cosmopolitan crop plants and crop diseases and pests. Other species include horticultural species which are grown commercially around the world. It therefore appears that species of relevance to Chad that are found in the patent system have been acquired from alternative sources.

Patent Claims:

A patent application may contain multiple claims but is required to contain only one invention. The first claim sets out the major focus of the claimed invention and frames all other claims.

Patents are awarded for three main classes of invention:

- a) Compositions of matter
- b) Methods or processes
- c) Machines

In some jurisdictions claims may be permitted for new plant varieties either under standard patent legislation or under specific legislation (e.g. US Plant Patents).

The first major formal category of patent claim is for compositions of matter (compositions). Compositions are commonly extracts, compounds or combinations of ingredients (e.g. in pharmaceuticals or cosmetics and herbal medicines). Patent claims for compositions typically include a list of the compounds or ingredients that are the subject matter for protection. These claims are frequently broadly constructed such that the use of compounds from the species, the genus, and in some cases the family, are incorporated into the scope of the claims. While composition of matter claims may be constructed in various ways, broad claims may well impinge upon the ability of producers from a country to export products containing the claimed components into markets where a patent is in force.

The second category of patent claims is for methods, such as methods of producing a plant, a compound or other desired outcome. Method claims are frequently more restrictive in their coverage of genetic resources because the genetic component is only claimed in so far that it is relevant to performing the method. That is, it is the method that is the focus of the invention. Therefore it is the method, and the use of the claimed genetic or biological component in performing that method, that is the subject matter of protection.

Patent activity that involves claims to a process or processes are similar to methods claims. Typically, these claims focus on the process for producing or manufacturing a desired product (such as a chemical, a cosmetic or a beverage). It is the process itself that is the focus of the invention.

As this brief discussion of patent claims suggests it is important to pay close attention to both the type and the content of patent claims. In addition, it is important to establish whether a patent has been granted, the jurisdictions where a patent has been granted, and whether it is in force. This type of analysis is particularly important when considering the potential development of products for markets. However, detailed patent analysis such as freedom to operate, patent validity, patentability, patent infringement and patent landscape analysis requires specialist analysis beyond the scope of the present report. Given the increasing importance of these issues for economic development, the World Intellectual Property Organization has established a Patent Landscaping initiative under its development agenda that commissions specialist patent research at the request of member states.³

Concluding Remarks:

It can be seen from other African country studies in this series of reports into patent activity, that the acquisition of biological materials varies greatly from country to country. A number of countries such as Madagascar, South Africa and Kenya have been the source of many such acquisitions. Other countries have been found to have little or no activity. Despite a thorough and extensive review of patent documents featuring species known to

³ http://www.wipo.int/patentscope/en/programs/patent_landscapes/

have Chadian distribution and patents which mention the country name no evidence was found to suggest that any species have been obtained from Chad.

Observations made during the course of this analysis that help to understand this situation are as follows:

Firstly, as stated above, the available data on species which have Chadian distribution appears to be very sparse. Only 1,350 resolved species names are recorded in GBIF data, with only 2,200 georeferenced records. This extremely low number suggests that there is insufficient knowledge about biodiversity in the country.

The species known to be distributed in Chad and which are found in the patent landscape are dominated by crop species, crop pathogens and pests and one horticultural species. These species are all cosmopolitan with wide (often global) distribution. This distribution ensures that the species which appear in patents are available from a large number of sources. The companies and other assignees identified are multinational companies or institutions based in developed countries and it would seem impractical to acquire organisms from Chad when they are likely to be available for less effort and expense elsewhere.

Non-crop species known to be distributed in Chad are widely distributed throughout Africa, including those countries listed above which have a high level of activity. It would appear that the accessibility of those countries again enables acquisition of organisms for less effort.

The most common mentions of Chad in patent documents were references to Lake Chad being one of a number of places where people have historically eaten algae, included as background information to inventions. Other references encountered were distribution lists of species such as *Acacia seyal* and *Juglans regia* (walnut), cosmopolitan commercial-crop trees where product was purchased elsewhere.

These findings and observations do not mean that biodiversity and traditional knowledge in Chad is unimportant. Nor do these findings signify that biodiversity and traditional knowledge in Chad are not relevant to research and development. Instead, it implies that based on available evidence there is very little reason to be concerned about biopiracy and that experience in other African countries could usefully inform policy development in Chad in developing capacity in access and benefit-sharing.

The purpose of this report has been to highlight the existing and potential role of species of relevance to Chad for economic development in support of conservation. We would emphasise that our aim has not been to identify cases of biopiracy or misappropriation. In addition the aim of the research was not to identify the complete portfolio of patent activity for a particular species or genetic resource. We have focused on those patent documents that make direct reference to Chad or where distribution data suggests that Chad is a likely source.

Appendix 1

Distribution map of GBIF records in Chad coloured by taxonomic kingdom.

