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ANALYTICS

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

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Introduction

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

Section 1 provides an overview of biodiversity in Rwanda 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 Rwanda in the period 1976-2010. This is followed by detailed analysis of patent documents that make reference to Rwanda and data based on species that are limited to distribution in Rwanda.

Section 3 provides a set of short summaries for species that are a focus of patent activity. This information will also be made available online for further research through the Access and Benefit Sharing Patent Index (ABSPAT).¹

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 Rwanda. 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 Rwanda published anywhere in the world between 1900 and 2013. As such the report provides a baseline for patent activity involving species from Rwanda as a basis for further research.

Our research focused primarily on documents that make reference to Rwanda and to cases where existing distribution data suggests Rwanda 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.

¹ ABSPAT is available at <http://www.abspat.net>

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. Georeference 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.²
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

² Oldham, P & Burton G (2010) *Defusing Disclosure in Patent Applications*. UNEP/CBD/COP/10/INF/44

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, 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.

Rwanda

Area:

26,338 sq. km.

Coastline:

Landlocked

Climate:

Tropical, two rainy seasons (February to April, November to January); mild in mountains with frost and snow possible.

Geography:

Mostly grassy uplands and hills; relief is mountainous with altitude declining from west to east.



Biodiversity in Rwanda 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 participants who share biodiversity information.

Using this resource we have obtained biodiversity records for species which occur in Rwanda. 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 3,292 resolved species names for Rwanda with 16,037 georeferenced coordinates for the occurrences of these species in Rwanda.

We identified a total of 77,345 documents containing species known to be distributed in Rwanda. Of these, 6 made some form of reference to Rwanda. These documents were manually reviewed in MAXQDA software to identify documents specifying a source or origin in Rwanda.

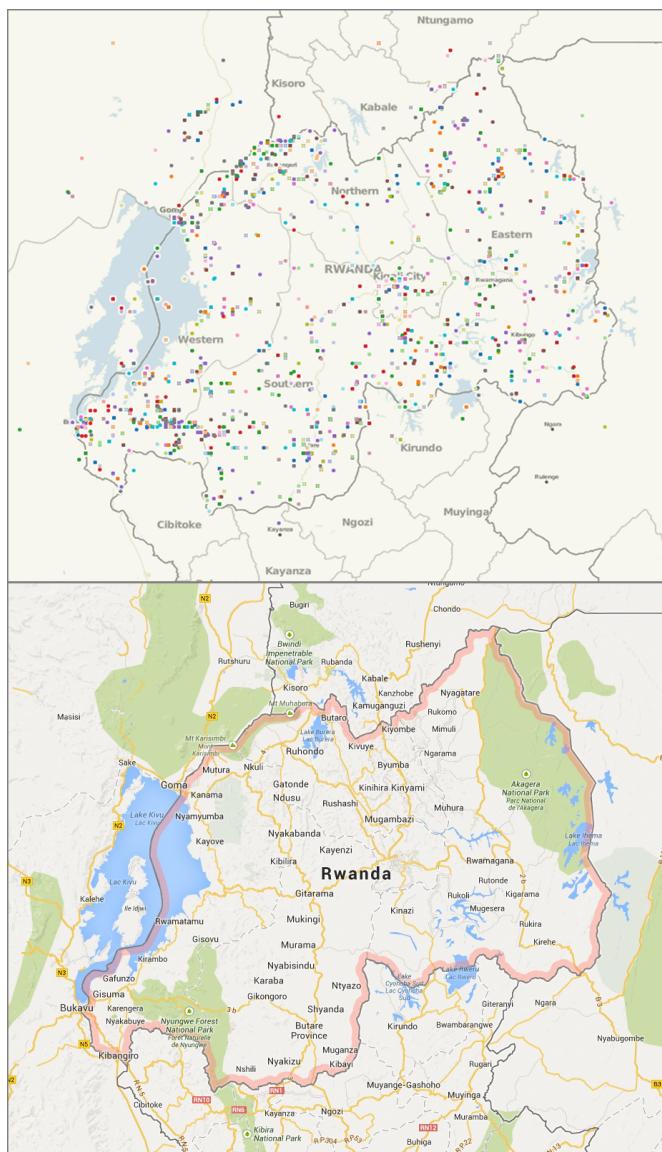
The 6 documents that made a specific reference to Rwanda contained 20 species. These documents were manually reviewed in MAXQDA data analysis software and through this process we were able to identify species where it was definitively stated that they had been collected, sampled or otherwise obtained from Rwanda.

In addition, using GBIF distribution data we carried out a search for species where GBIF presently records distribution only in Rwanda. However no species were identified. The idea behind this was to identify cases where a species (based on available distribution data) was likely to have come from Rwanda and thus be regarded as a species of likely or potential significance for Rwanda.

Finally, we carried out an additional search across all global patent jurisdictions for any documents featuring the country name Rwanda published between 1900 and 2013. This search identified 351 raw documents with 33 documents containing species names which were manually reviewed using MAXQDA software. This search was undertaken to ensure that as much up-to-date data as is available was incorporated into the results. For the sake of simplicity we call this data ‘Global 2013’.

Biodiversity and Distribution:

Much of the data submitted to GBIF includes geographical coordinates indicating where the recorded species was located. A total of 16,037 coordinates were available for Rwanda. Using this data we are able to show the physical distribution across Rwanda of all GBIF recorded species. Plate 1 shows two maps: The upper 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 lower map shows major settlements and roads. It also includes the location of some protected areas such as Akagera National Park in the east, Nyungwe National Park in the south west, The Volcanoes National Park in the north and Gishwati Forest Reserve - 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.



In comparing the two maps we can see that there are some dense clusters of georeferenced records and that these are located at two of the areas with statutory protection, namely The Volcanoes National Park and the Nyungwe National Park. That there is such a density at The Volcanoes National Park is no surprise as this is a much studied area due to the mountain gorilla (*Gorilla beringei beringei*) populations for which it is famed. The Nyungwe National Park is an area regarded as one of the best preserved areas of African rainforest and an important conservation area, so again it is not surprising to see such extensive recording. The distribution map shows that records across the remainder of the country appear to be densest in the south, but are very limited across the rest of the country. As with other African countries in this series of studies it is apparent that the records closely follow roads and are denser when close to populous areas. It is interesting that there does not appear to be any clustering of records along the shores of Lake Kivu in the west - Large lakes and shores are often well recorded locations. 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 Rwanda.

GBIF presently records 3,538 species known to be present in Rwanda (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 all but 186 species as can be seen in Table 1. These other kingdoms are quite well represented however, and this illustrates, that in some areas at least, a high level of recording appears to have been carried out.

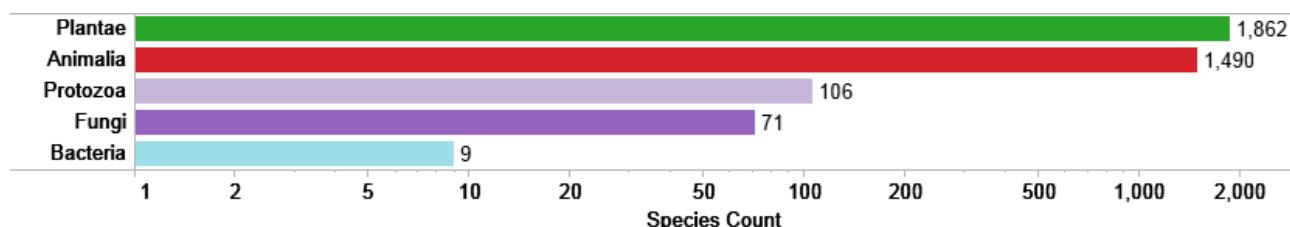


Table 1: Showing the number of species in Rwanda by kingdom using GBIF data.

Using global data it is possible to examine the wider distribution of Rwandan 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 Rwanda 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 notably in those countries in east Africa which have shared biomes. A much smaller number have global distributions, 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.

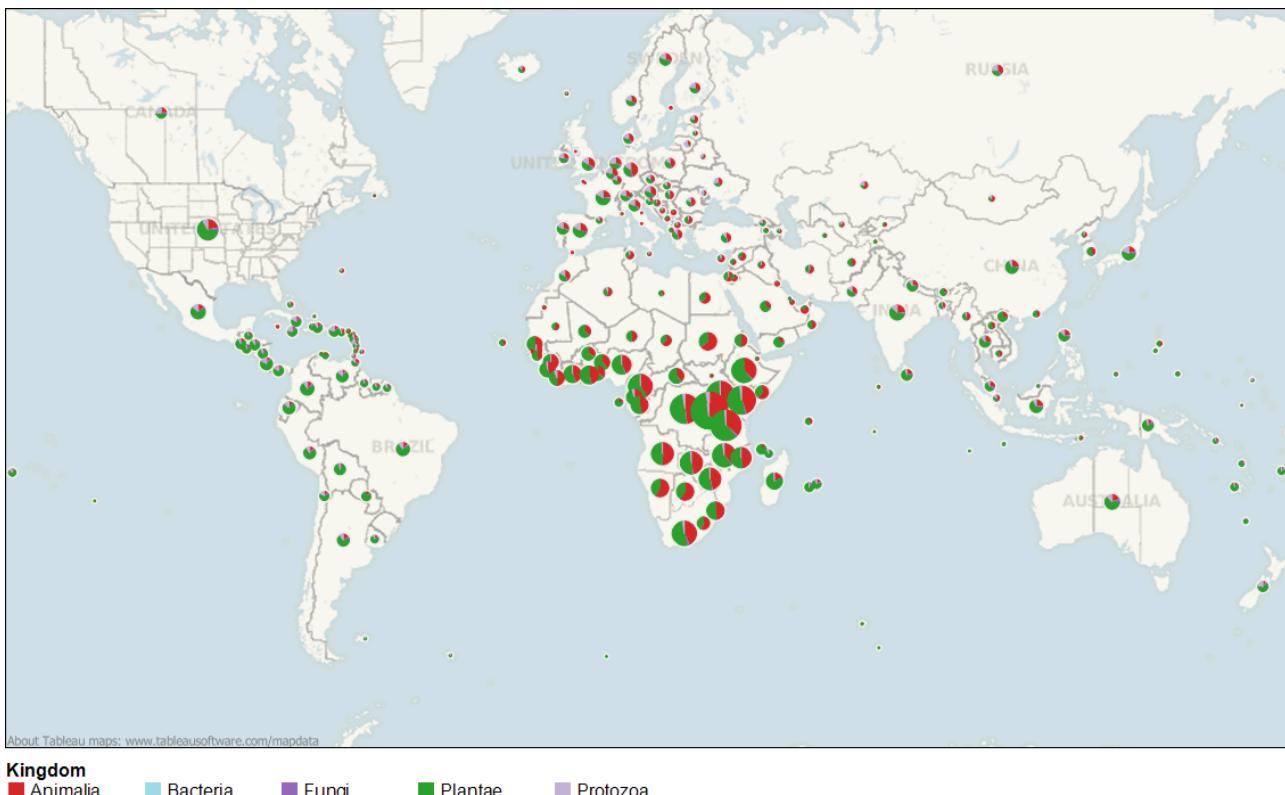


Plate 2: Global distribution of Rwandan species shown by Kingdom and the number of species recorded in GBIF.

Biodiversity in Rwanda in the Patent System

As of 2013 a total of 278 patent documents in the main patent jurisdictions (European Patent Office, the United States, and the Patent Cooperation Treaty) specifically mention Rwanda. This provides a general overview of references to Rwanda 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, Rwanda. In addition, patent applicants will make reference to species that originate from Rwanda but will not mention Rwanda 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 Rwanda. 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 Rwanda. In approaching patent activity for genetic resources from Rwanda we focus on three categories of data.

1. Species that are known to be distributed in Rwanda but are also distributed elsewhere in the world. This provides an overview of global patent activity for genetic resources of relevance to Rwanda.
2. Species where a direct reference is made to the collection or origin of a species from Rwanda. 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 Rwanda. This data is known as Distribution data and refers to cases where GBIF presently only records a species as occurring in Rwanda and no other country. Because taxonomic information is incomplete, this data provides a clue rather than proof that a species originated from Rwanda.

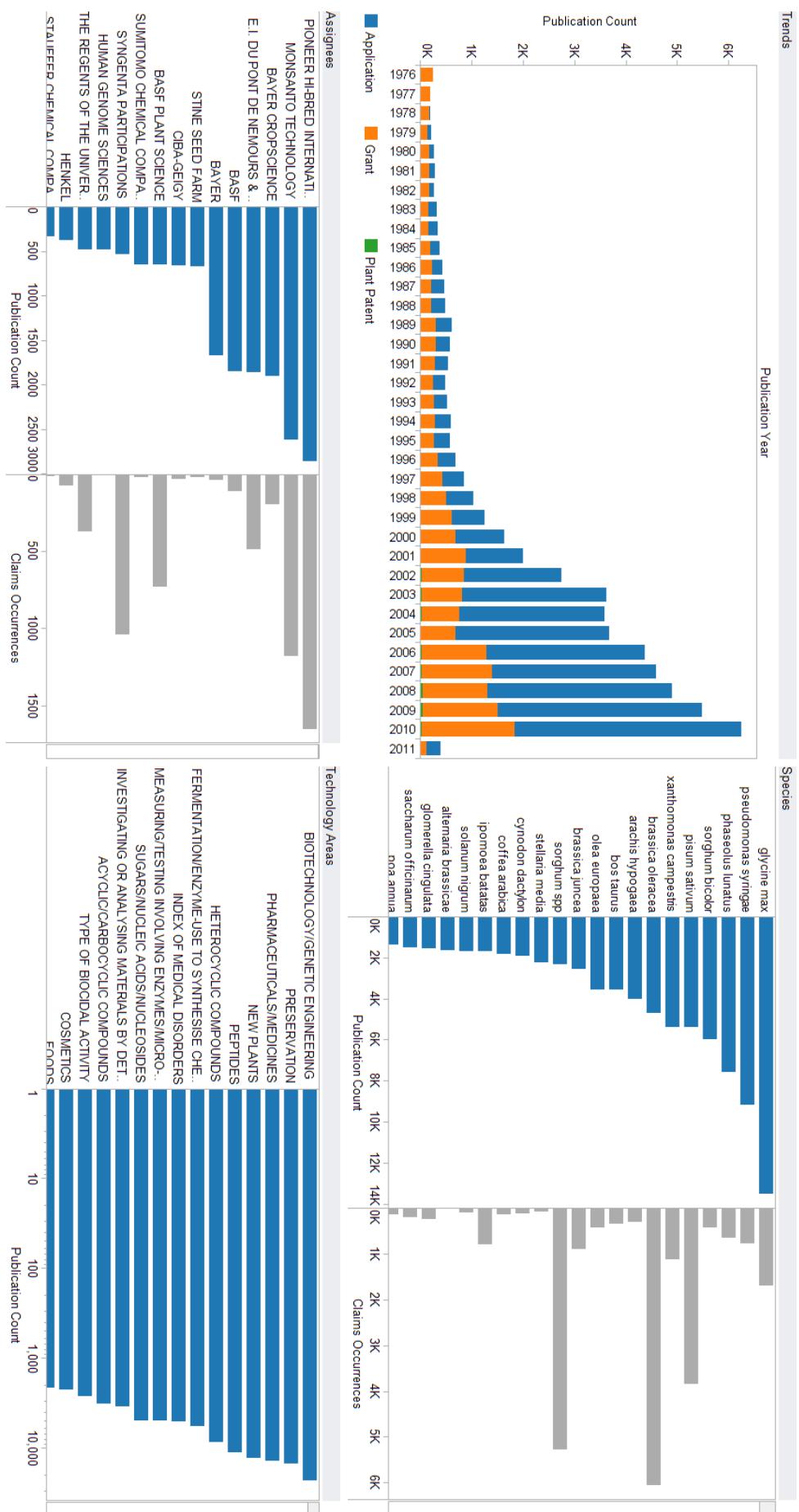
We begin our analysis with an overview of biodiversity that is known to occur in Rwanda in the patent system and then turn to data on species originating from Rwanda.

Rwanda 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 Rwanda 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 Rwanda, top applicants or assignees and technology areas.

In total we identified approximately 707 species names in patent data from the major jurisdictions that are known to occur in Rwanda. When model organisms including crops such as *Zea mays* (maize) and *Homo sapiens* are excluded this falls to 692 species names and 505 accepted scientific names.³ This data is relevant for Rwanda because it demonstrates that researchers and companies are conducting research and development on species that are known to occur in Rwanda. 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.

³ The 505 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 Rwanda.



In total we identified 329 plant names in global data of relevance to Rwanda with crops represented by species including varieties of soya (*Glycine max*), beans (*Vicia faba* and *Phaseolus lunatus*), peanut (*Arachis hypogaea*), cereals (*Sorghum spp*, *Hordeum vulgare* and *Triticum aestivum*), papaya (*Carica papaya*), pepper (*Capsicum annum*), cotton (*Gossypium barbadense*), mango (*Mangifera indica*), senna (*Senna obtusifolia*), sweet potato (*Ipomoea batatas*), apple guava (*Psidium guajava*) and tobacco (*Nicotiana tabacum*). Other species include the soil-dwelling plant pathogen *Fusarium oxysporum*, *Momordica charantia* or bitter melon which is grown as a food crop and has pharmaceutical uses and the nightshades *Datura stramonium* and *Solanum nigrum*, which have traditional medical uses. Insects are represented by the Pharaoh ant (*Monomorium pharaonis*) which is a pest species in buildings across the world. As can be seen, this list is dominated by crops and crop pest species.

The assignees in the overall data for species of relevance to Rwanda range across a spectrum from biotechnology (e.g. Genentech and Novozymes), 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 and Novo Nordisk which specialises in treatments for diabetes. Also companies which develop new crops such as Syngenta, Monsanto and Stine Seed feature prominently as does Sumitomo Chemical, which has interests in pharmaceuticals and crop science. As this makes clear, there are a wide range of general and specialised technology areas and markets of relevance to biodiversity from Rwanda, and this fact is linked to the broad range of species and kingdoms recorded in the country. 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 Rwanda or where distribution data suggests that Rwanda is the likely source.

Species from Rwanda in Patent Data:

In total we identified just one species of organism that originated from Rwanda. In the next section a summary is provided for this species. This data will also be made available online.

Based on detailed analysis of patent documents, just one species appears in the data compared with the overview provided in Plate 3. This species is *Ocimum canum*, a species of African basil which is also known as hoary basil or African mint. It has wide distribution across sub Saharan Africa with a small distribution across Australia and the Americas. The University of Montana Research and Development Institute claim a new method of controlling insects using a herbal preparation. The abstract of the application states: "Preparations from aromatic plants that are insecticidal or are insect behaviorally active, are used to control the development of insect populations. Leaves are milled or out drying to a small average particle size. Extracts and vapors may also be used. The resultant preparation, when contacted dry commodities or structures such as books or carpets, grain bins feed/flour mills, equipment, greenhouse or ornamental plants infested storage insects or insect infested perishable produce after harvest will reduce the insect population" (US5591435A).

Evidence that the herb was sourced from Rwanda is found in the description: "Quantification of linalool from leaves of *Ocimum canum* were collected form the Butare prefecture in Rwanda, air-dried according to traditional practice, and express-shipped to Montana State University where they were stored in a -20 DEG C. freezer prior to bioassay and chemical analysis" (US5591435A).

Full details of this species identified in the research are provided in the final section of this report. In considering this data we would note that, despite the lack of evidence suggesting species sourced from Rwanda, cosmopolitan species that are native to several African countries, may hold significant potential for collaboration in economic development and conservation.

Rwanda has a broad portfolio of recorded species that includes five kingdoms. This range of organism types increases the number of technologies for which biodiversity from Rwanda becomes relevant and subsequently increases the number of species with Rwandan distribution that are seen in patents. It is important to emphasise that species may be involved in research and development in different areas of science and technology and may serve different markets. In some cases a species may be the target of a particular invention. In other cases a patent may suggest potential uses of a particular organism while in others, the species will be the direct focus of the claimed invention. We now turn to more detailed analysis of the technology areas involving species relevant to Rwanda.

Technology Areas:

The general overview of technology areas provided in Plate 3 emphasises biotechnology, pharmaceuticals and medicines. However, in the case of *Ocimum canum* the technology area is that of insecticides where the species is part of a composition from which linalool extracted from the plant is used for an insecticide which utilises the properties of several species.

Patent Claims:

Additional insights can be provided by examining the types of claims that are being made in relation to the species. 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 (i.e. US Plant Patents).

Table 2 displays a summary of the top terms appearing in patent claims relating to genetic resources for Rwanda.

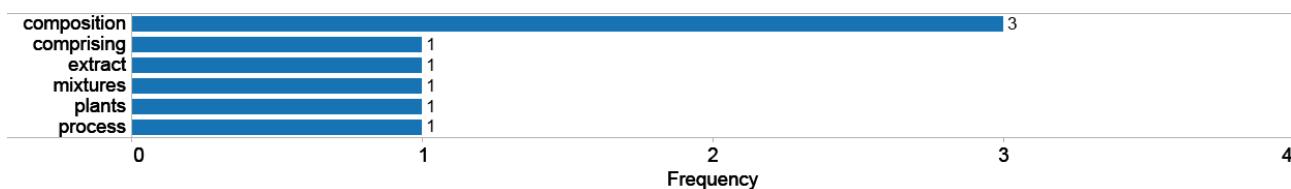


Table 2: Terms Appearing in the First Claims of Patent Documents

The first category of patent claim within this document 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. In this case the first claim is for “An insecticidal composition capable of killing insects, comprising an insecticidal amount of a composition made by a process of preparing a solid super critical CO₂ extract of dried leaves of mixtures of two or more aromatic plants selected from the group consisting of the mint family, the sagebrush genus *Artemisia*, *Geranium viscosissimum*, and *Balsamorhiza sagittata*; and vapors of said composition.” (US5591435A).

The second major general category of patent claims is for methods, such as methods of producing a compound or treatment which leads to a 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.

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.⁴

⁴ http://www.wipo.int/patentscope/en/programs/patent_landscapes/

Global Impacts and Global Markets:

We have seen above that a range of species are involved in patent activity with potential relevance to Rwanda. However, it is important to note that many patent applications simply go nowhere. They may embody the hopes and ambitions of individuals, researchers, universities and companies but do not ultimately have an impact either in the patent system or in the market. A means for identifying important patents is therefore needed. Here we discuss two measures: a) patent citations, and; b) patent families.

Table 3 displays the citation score by species and assignee for species relevant to Rwanda (*Ocimum canum*). When a patent is filed and published it becomes prior art. Later patent applications that make claims for the same invention will find that the scope of what they claim as being new or involving an inventive step, will be limited by these earlier claims. This is recorded in the patent system as a citation. The more often that a patent is cited by later patent applications is a measure of the importance and impact of that patent within the patent system. In some cases a single patent application may attract over a thousand citations (i.e. *Thermus aquaticus* in biotechnology). Patent citation counts are therefore an important measure of the importance of patent activity because these scores reveal the impact of patent activity on other applicants.

In the case of Rwanda Table 3 reveals the citation scores for species of relevance to Rwanda organised by species and assignee. As can be seen, the species *Ocimum canum* has received eleven citations.⁵

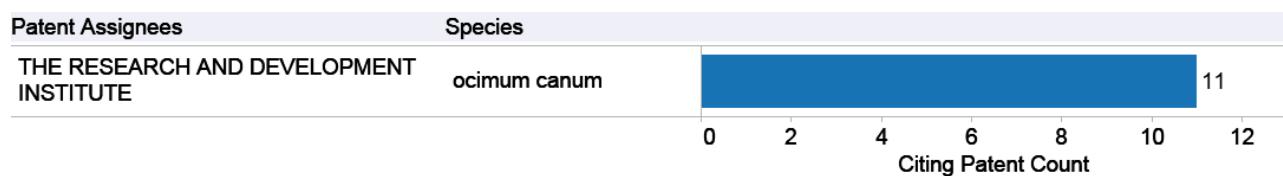


Table 3: Species and Assignee Citing Patents

A second measure of the importance of patents is provided by the size of patent families. Table 4 shows the numbers of patent family members. A patent family is simply a set of patent documents that link back to an original parent filing (known as a “priority” filing). These patent documents can be filed anywhere in the world and can be tracked using unique identifiers known as INPADOC numbers that link back to the parent document.⁶ In contrast with patent citations that provide an indicator of the impact of a patent on other applications in the patent system, the size of a patent family reveals how important a patent is to applicants. The reason for this is that they must pay fees each time they file a patent application that is linked to the parent (priority) application.

Patent family data of this type is useful in revealing the applicants who are most vigorously pursuing patent protection involving a species, or as is frequently the case, a group of species around the world. In this case The University of Montana Research and Development Institute has a family size of just two.

⁵ Table 5 aggregates the patent scores by species and assignee. If an assignee has four documents with citations involving the species, the numbers are aggregated to arrive at the total.

⁶ INPADOC stands for the International Patent Documentation Centre which established the system. INPADOC is now part of the European Patent Office.

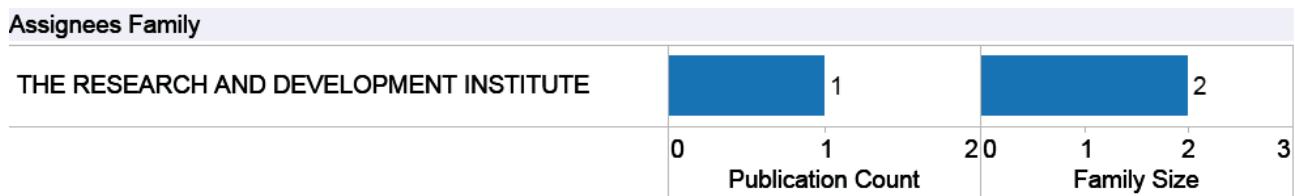


Table 4: Patent Assignees and Patent Families

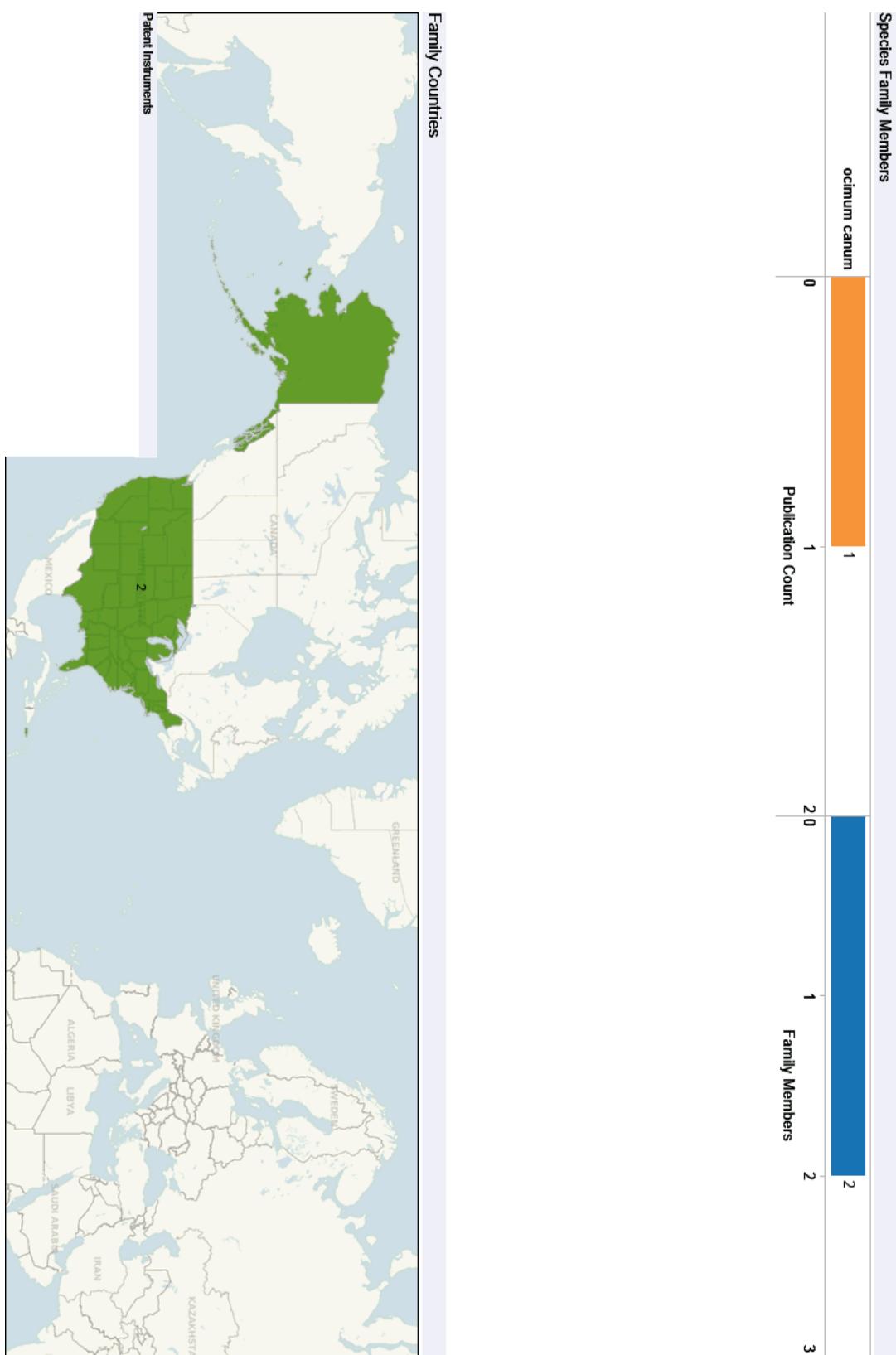
As this makes clear, while care is required in analysing why a particular species is referenced in a patent document, it is possible to trace the economic importance of particular patents to patent applicants using patent family data.

This type of analysis can be extended to the species level to consider the global impacts of patent activity and the position of patents involving a species in global markets.

Plate 4 displays patent family data by species and a global map of countries where family members linked to the species have been recorded. Please note that the map does not display the geographical locations for regional and international patent offices. Plate 4 is useful because it reveals what might be called the global reach or careers of species.

Analysis of this type is also useful because it exposes the markets where protection is being sought as provided in the Family Countries map. In the case of Rwanda the species *Ocimum canum* is only protected in the United States of America. It is also striking that available data suggests that patent applicants are not pursuing protection in Rwanda or other African countries. This suggests that opportunities may exist within internal markets in Africa where patent protection is unlikely to prove to be a barrier. At the same time, patent data also suggests countries where markets may exist for products involving biodiversity from Rwanda.

Plate 4: Global distribution of family members.



Concluding Remarks:

The research into biodiversity and patent activity featuring species originating from Rwanda has been notable by the very limited references to collection from the country. No documents were identified which referred to species where the available data suggests that a species is endemic to Rwanda. Therefore the analysis was restricted to documents which contained reference to a species known to be distributed in Rwanda and also referred to the country name. In the case of the one species identified as being of relevance to Rwanda this relevance was due to the materials being sourced from Rwanda.

Rwanda is a small, land-locked country with poor infrastructure, that is likely to share much of its biodiversity with neighbouring countries such as the Democratic Republic of Congo and Tanzania. The relatively low number of species recorded in data held by GBIF suggests that insufficient records are available to build a complete picture of the true diversity that exists, and the georeferenced records suggest that most recording has been carried out in biodiversity hotspots such as The Volcanoes National Park. The reasons for the lack of activity in the patent record can only be a matter of speculation in the context of this report. Political and social upheavals in past decades and the relative ease of accessibility to other countries from which collections of species could be made may have contributed to the lack of focus on Rwandan biodiversity. This does not mean that biodiversity and traditional knowledge in Rwanda are unimportant. Nor do these findings signify that biodiversity and traditional knowledge in Rwanda 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 Rwanda 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 Rwanda 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 Rwanda or where distribution data suggests that Rwanda is a likely source.

The next section presents a summary card for the species identified in the course of the research.

Species Summary Tables

The following summary table describes the species and patent activity involving the species. This data is based on known distribution of species and, in the case of Rwanda, reference to traditional knowledge and use of that species:

In reading these tables note that the number of documents refers to the number of documents retained during research on the origin of species of relevance to Rwanda. It does not refer to the wider patent landscape for the species consisting of the total of number of documents making reference to the species, or its components, in the global patent system.

Species may appear in patent documents in this list for a variety of reasons:

1. Because they are a focus of the invention;
2. Because they are a target of the invention (i.e. pathogens);
3. Because they are incorporated into the claims of the invention;
4. Because a reference to a species, including in very limited cases a literature reference, indicates that the species is of potential interest for economic development and merits further investigation.

This report focuses on identifying species that are of potential interest for economic development and conservation based on their appearance in patent data. The data in this summary section should not be used to draw conclusions about misappropriation or biopiracy.

Of Rwandan origin

Species name: <i>Ocimum canum</i>	Kingdom: Plantae	
Brief description of species: A species of African basil, also known as African mint. An aromatic herb.		
Distribution: Cosmopolitan	No of documents: 1	
US5591435A		
Detail: This patent is for an insecticidal compound developed using active compounds from a variety of aromatic plants.		

Image Credit

Ocimum canum - Marco Schmidt [thumb_Ocimum_canum_MS_1416_2021_54360b.JPG](#)

Appendix 1

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

