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# A global assessment of extractive activity within natural World Heritage sites

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# A global assessment of extractive activity within natural World Heritage sites.

## Summary

The impact of the extractive industry (commercial mining and oil and gas exploration and extraction) upon natural World Heritage Sites (WHS) has recently emerged as an issue of concern. In order to better understand the issue, WWF-UK conducted a global assessment of extractive activity (defined as the commercial exploration, extraction and processing of minerals, metals, hydrocarbons and other geological materials) within natural and mixed WHS in July 2015. This document outlines the results of this research.

Extractive activity within natural WHS was identified by comparing natural (197) and mixed (32) WHS (hereafter natural WHS) with commercial mining operations and concessions and oil and gas operations, infrastructure and concessions. To enable the comparison, data defining the spatial location of extractive assets was sourced from the SNL Metals and Mining database and the DrillingInfo oil and gas database and compared to natural WHS as spatially defined by the IUCN and UNEP-WCMC World Database on Protected Areas (WDPA).

Both the SNL Metals and Mining database and the DrillingInfo database did not provide comprehensive global coverage of extractive activity (Appendix 1 – 5). As a result, it was not possible to compare 3 / 229 WHS (1.31%) against mining projects, 129 / 229 (56.33%) against mining concessions and 45 / 229 (19.65%) against oil and gas concessions. **As a result of the imperfect datasets, the extent of extractive overlap into natural WHS summarized here is not comprehensive but only illustrative of the data available.**

Despite the limitations of the research, a significant volume of extractive activity within natural WHS was identified; 38% (38 / 100 WHS) contained mining concessions, 21.74% (40 / 184 WHS) contained oil and gas concessions, and 5.31% (12 / 226 WHS) contained mining operations. Overall, 70 / 229 natural WHS (30.56%) were identified as being overlapped by one or multiple forms of commercial extractive activity. This is mostly likely an underestimate of the true extent of extractive activity in natural WHS considering the extensive data omissions within the source data and the conservative interpretation of the data.

## Introduction

Protected areas<sup>1</sup> form the foundation of modern conservation. They are widely considered to be the most important method we have for protecting biodiversity and the natural world. Within the global network of protected areas, natural World Heritage Sites (WHS) are generally thought to be the most significant.

Currently there are 197 natural WHS<sup>2</sup> and 32 ‘mixed’<sup>3</sup> WHS inscribed under the World Heritage Convention. Found in 97 different countries, these 229 sites (hereafter natural WHS) cover less than 1%<sup>4</sup> of the Earth surface, around 8%<sup>5</sup> of the area contained within protected areas worldwide.

Unfortunately, natural WHS, like all protected areas, face a range of threats from factors such as climate change, invasive species, biological resource use, industrial activity and agricultural expansion.<sup>6</sup> Of growing concern is the threat posed from commercial mining, oil and gas exploration and extraction<sup>7</sup>, because such activity risks significantly impairing, or even negating, the Outstanding Universal Value (OUV)<sup>8</sup> of natural WHS. In recognition of this risk, both the World Heritage Committee<sup>9</sup> and the IUCN<sup>10</sup> have stated repeatedly that extractive activities are incompatible with natural WHS status.<sup>11</sup>

Despite the significance of the issue, the first attempt at a global assessment of commercial extractive activity overlapping natural WHS was not conducted until mid-2013 by the United Nations Environment Programme's World Conservation Monitoring Centre (UNEP-

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<sup>1</sup> IUCN 2013

<sup>2</sup> One natural World Heritage Site has been delisted. The Arabian Oryx Sanctuary in Oman was delisted in 2007 due to Oman's decision to reduce the size of the protected area.

<sup>3</sup> Sites are inscribed onto the World Heritage List either due to their natural or cultural significance; sites which meet both natural and cultural criteria are often informally referred to as ‘mixed’ WHS.

<sup>4</sup> Natural WHS are estimated to cover 279 million hectares and the Earth's surface is roughly 51 billion hectares; as a result natural WHS cover an estimated to be 0.54% of the Earth surface, commonly reported as ≤1% of the Earth's surface (IUCN 2015).

<sup>5</sup> Osipova et al. 2014.

<sup>6</sup> UNESCO 2015.

<sup>7</sup> Turner 2012; ZSL unpublished data.

<sup>8</sup> Outstanding Universal Value (OUV) is the central requirement for inscription of a site on the World Heritage List and refers to “cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity” (UNESCO 2013).

<sup>9</sup> The United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Committee is the body accountable for the implementation of the World Heritage Convention.

<sup>10</sup> The International Union for Conservation of Nature (IUCN) is the advisory body to the World Heritage Convention on natural World Heritage.

<sup>11</sup> World Heritage Committee 2013; 2014; IUCN 2013b.

WCMC).<sup>12</sup> Since this publication no further global assessments have been published. To help improve the understanding of the current extent of the issue, WWF-UK conducted a global analysis of extractive activity within natural WHS in July 2015. Spatial data defining the location of extractive operations and assets was sourced from two industry datasets, the SNL Metals and Mining database and the DrillingInfo database, and compared against the boundaries of natural WHS as defined by the IUCN and UNEP-WCMC World Database on Protected Areas (WDPA).

A global comparison between all 229 natural WHS and extractive assets was not possible due to a lack of data coverage defining extractive activity for some countries. As a result the extent of extractive overlap with natural WHS summarized here is only illustrative of the data available (Appendix 1-5). **However despite these limitations at the time of publication, the research arguably provides one of the most comprehensive global assessments of extractive activity within natural WHS.**

## Report Objective

The aim of this research was to identify and summarise any significant spatial overlap between commercial extractive assets and ‘natural’ and ‘mixed’ World Heritage Sites (WHS).

## Source Data

This document compares natural WHS with extractive assets as defined by the SNL Metals and Mining database<sup>13</sup> (mining concessions and commercial mines) and data from the DrillingInfo database<sup>14</sup> (oil and gas concessions, pipelines and historic and active wells). The location and boundary of natural WHS was defined using the IUCN and UNEP-WCMC WDPA.<sup>15</sup>

Data was sourced from the WDPA on the 11<sup>th</sup> June 2015, from the DrillingInfo database on the 20<sup>th</sup> July 2015 and from the SNL Metals and Mining database on the 27<sup>th</sup> July 2015.

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<sup>12</sup> UNEP-WCMC 2013

<sup>13</sup> SNL 2015

<sup>14</sup> DrillingInfo 2015

<sup>15</sup> IUCN and UNEP-WCMC 2015

## Methodology

The methodology has two major components. Firstly, a GIS analysis recorded any spatial overlap between extractive assets and natural WHS. Secondly, data validation checked the results of the GIS analysis to remove any marginal data which could potentially bias the results and thus distort the extent of extractive activity in natural WHS.

Each component of the methodology is described below:

### 1) Overlap Analysis

A GIS analysis was conducted focussing on the intersections of extractives activities with natural WHS. The spatial delineation of natural WHS was extracted from the IUCN and UNEP-WCMC WDPA. Oil and gas activities (oil and gas concessions, pipelines and historic and active wells) were defined by the DrillingInfo database while mining activities were defined using the SNL Metals and Mining database (mining concessions and commercial mines). Data (shape files and file geodatabases) was sourced from these datasets on the 11<sup>th</sup> June 2015, 20<sup>th</sup> July 2015 and 27<sup>th</sup> July 2015.

Once the data was sourced, a GIS analysis was conducted using ArcGIS 10.3.1 to intersect natural WHS and extractives activities, thereby computing the overlap for each type of extractive activity. In addition, the distance of a mining project to the boundary of a WHS was calculated within the SNL Metals and Mining Platform.

### 2) Data Validation

All data extracted during the 'Overlap Analysis' was exported into MS Excel. Data was sorted, filtered and combined using standard MS Excel functions to provide an overall summary of extractive assets within natural WHS.

This process attempted to remove marginal data perceived as distorting the extent of extractive overlap with natural WHS. To ensure the robustness of the results reported, a conservative approach has been taken in an attempt to ensure only indisputable extractive overlap is reported.

In order to ensure the robustness of the results reported, the following filters were applied to the dataset:

### **Mining Projects:**

- Exclusion of all mines with a minimum distance to the boundary of the WHS  $\leq 2$ km
- Removal of all mines with a development stage 'Closed'
- Exclusion of all mines with an activity status of 'Inactive'
- Removal of all mines with a coordinate accuracy of 'Best Guess' and a distance to the boundary of the WHS  $\leq 10$ km
- Removal of all mines with a coordinate accuracy of 'Approximate' and a distance to the boundary of the WHS  $\leq 5$ km
- Removal of any mines where the distance to the boundary of the WHS could not be calculated.

### **Mining Concessions:**

- Exclusion of all mining concessions which expired before 01/06/2015. All mining concessions with no expiry date listed remain included.
- Removal of all mining concessions which have  $\leq 1.0$  Sq. Km overlap with a WHS.
- Removal of all mining concessions with an unnamed direct owner.

### **Oil and Gas Concessions:**

- Removal of all oil and gas concessions with an overlap of  $\leq 5.0$  Sq. Km
- Exclusion of all oil and gas concessions which are 'Not Operated', i.e. currently unowned.

### **Oil and Gas Assets (Pipelines and Wells):**

- Removal of oil and gas pipelines with an overlap length of  $\leq 1.0$  Km.
- Exclusion of all oil and gas pipelines which are 'Planned' or 'Proposed'.
- Exclusion of all oil and gas wells with a spud date before 01/01/1970.

## Limitations and Constraints

While efforts were made to source the best data available, it was not possible to consider all extractive assets against all natural WHS. This section explores some of these limitations and constraints.

- The version of the IUCN and UNEP-WCMC WDPA used for the analysis did not include the most recent natural WHS inscription, Blue and John Crow Mountains in Jamaica, and therefore this WHS was excluded from the analysis.
- The location of mining projects as described in the SNL Metals and Mining database are not consistently accurate; each mine is listed under a category of accuracy, ranging from 'Exact' to 'Best Guess'. Subsequently, the 'Distance to WHS Border' or any other subsequent calculations may carry this spatial error forward.
- It was not possible to measure the 'Distance to WHS Border' for mines within two WHS, Mount Hamiguitan Range Wildlife Sanctuary and Tajik National Park (Mountains of the Pamirs), due to the version of the IUCN and UNEP-WCMC WDPA available within the SNL Metals and Mining database. Therefore, they were excluded from the analysis.
- While the SNL Metals and Mining database provides one of the best global databases on commercial mining activity, it was not possible to consider 129 natural WHS against mining concessions due to lack of coverage within the dataset (Appendix 1 and 4).
- Due to data gaps within the DrillingInfo database it was not possible to consider oil and gas activity for 45 natural WHS (Appendix 2 and 5). In addition historic wells or drill sites may well exist outside the oil and gas concessions recorded within the DrillingInfo database. Furthermore, any oil and gas concessions, other than those unused, may potentially contain active wells or active oil and gas operations.
- To ensure the robustness of the data reported, a conservative delineation was used to exclude any extractive activity which could be interpreted as having a limited or no impact upon a natural WHS. While this helps ensure only significant extractive activity is reported, it potentially excludes extractive activity which may impact natural WHS. For example, the exclusion of 'minor' overlap (mining concessions  $\leq 1\text{km}^2$ , oil and gas concessions  $\leq 5\text{km}^2$ ) may exclude extractive operations which do significantly impact upon the WHS.
- No attempt was made to evaluate whether the extractive assets were issued before the inscription of the natural WHS.
- Although it is recognised that artisanal mining - informal mining activities conducted by individuals, groups or communities often illegally - is a significant issue and impacts natural WHS, it was beyond the scope of this study.



## Results

Extractive overlap within natural WHS is considered to be mining projects, mining concessions, oil and gas concessions and oil and gas assets (pipelines and wells). The results report only extractive activity (as defined above) which is considered to significantly overlap natural WHS (see Methodology).

### Mining Projects

In total 20 mines were identified within 12 / 226 (5.31%) natural WHS (Table 1).

Subsequently, 214 / 226 (94.69%) natural WHS were identified with no or marginal overlap with mining projects. It was not possible to assess 3 / 229 WHS (1.31%) for mining projects.

Country	World Heritage Site	Property Name	Activity Status	Development Stage	Primary Commodity
Australia	Kakadu National Park <sup>16</sup>	Koongarra	Temporarily On Hold	Reserves Development	U <sub>3</sub> O <sub>8</sub>
	Wet Tropics of Queensland	Leichhardt Creek	Active	Reserves Development	Tin
Canada	Wood Buffalo National Park	Fate	Active	Exploration	Diamonds
China	Three Parallel Rivers of Yunnan Protected Areas	Langdou	Active	Reserves Development	Copper
		Zhongdian	Active	Operating	Copper
Guinea	Mount Nimba Strict Nature Reserve	Nimba	Active	Reserves Development	Iron Ore
India	Western Ghats	Kudremukh	Active	Operating	Iron Ore
Indonesia	Lorentz National Park	Grasberg	Active	Operating	Copper
Namibia	Namib Sand Sea	Dome	Active	Target Outline	U <sub>3</sub> O <sub>8</sub>
Peru	Río Abiseo National Park	La Estrella	On Hold Awaiting Financing	Target Outline	Gold
Russia	Lake Baikal	Kholodninskoe	Active	Feasibility	Zinc
		Nerudinskoye (Sininda-1)	Active	Operating	Gold
		Selenginsk	On Hold Awaiting Financing	Target Outline	Iron Ore
		Vodorazdelnoye	Active	Reserves Development	Gold
	Virgin Komi Forests	Chudnoye	Active	Prefeas / Scoping	Gold
Tanzania	Selous Game Reserve	Madaba-Mkuju	Active	Exploration	U <sub>3</sub> O <sub>8</sub>
		Mkindu	Active	Exploration	U <sub>3</sub> O <sub>8</sub>
		Mkuju River	Active	Grassroots	U <sub>3</sub> O <sub>8</sub>
		Mkuju South	Active	Exploration	U <sub>3</sub> O <sub>8</sub>
		Songea/Lindi	Active	Exploration	U <sub>3</sub> O <sub>8</sub>

**Table 1** – A table showing commercial mining projects identified within natural WHS.

<sup>16</sup> The Ranger mine is excluded from the results as technically it exists outside the WHS, in a tiny enclave within Kakadu National Park. This highlights how the analysis may be considered overly conservative. The Ranger mine has a long legacy of environmental incidents – most notably when in 2010 1.4 million litres of toxic slurry, containing radioactive waste and mud, was released into Kakadu National Park (The Guardian, 2013).

## Mining Concessions

In total 444 mining concessions were identified significantly ( $\geq 1\text{Km}^2$ ) overlapping 38 / 100 (38%) natural WHS (Table 2), while 62 / 100 (62%) WHS were identified with no or marginal overlap. Due to data gaps in the SNL Metals and Mining database it was not possible to evaluate mining concessions overlap for 128 natural WHS (Appendix 1 and 4). The Blue and John Crow Mountains (1 WHS) was excluded from the analysis due to data gaps in the version of the IUCN and UNEP-WCMC WDPAs utilised in the analysis. Therefore this report was not able to assess 129 / 229 (56.33%) natural WHS for overlap with mining concessions.

World Heritage Site	Number of Mining Concessions overlapping WHS	Estimated area of WHS overlapped by mining concessions (sq. Km)
<b>Argentina</b>	<b>6</b>	<b>164.14</b>
Los Glaciares National Park	6	164.14
<b>Australia</b>	<b>49</b>	<b>1,216.37</b>
Gondwana Rainforests of Australia	3	63.05
Great Barrier Reef	15	165.20
Greater Blue Mountains Area	6	48.98
Kakadu National Park	8	36.27
Ningaloo Coast	1	3.90
Purnululu National Park	2	29.02
Shark Bay, Western Australia	11	741.85
Uluru-Kata Tjuta National Park	1	90.15
Wet Tropics of Queensland	2	37.96
<b>Bolivia (Plurinational State of)</b>	<b>1</b>	<b>1.73</b>
Noel Kempff Mercado National Park	1	1.73
<b>Brazil</b>	<b>83</b>	<b>578.50</b>
Atlantic Forest Southeast Reserves	42	193.95
Cerrado Protected Areas: Chapada dos Veadeiros and Emas National Parks	24	248.14
Discovery Coast Atlantic Forest Reserves	16	122.38
Pantanal Conservation Complex	1	14.03
<b>Canada</b>	<b>5</b>	<b>13.61</b>
Wood Buffalo National Park	5	13.61
<b>Costa Rica; Panama</b>	<b>6</b>	<b>413.64</b>
Talamanca Range-La Amistad Reserves / La Amistad National Park	6	413.64
<b>Côte d'Ivoire</b>	<b>4</b>	<b>70.52</b>
Comoé National Park	3	39.90
Taï National Park	1	30.61
<b>Côte d'Ivoire; Guinea</b>	<b>6</b>	<b>181.72</b>
Mount Nimba Strict Nature Reserve	6	181.72
<b>Democratic Republic of the Congo</b>	<b>90</b>	<b>4,699.85</b>
Kahuzi-Biega National Park	22	1,192.00
Okapi Wildlife Reserve	63	3,450.66
Virunga National Park	5	57.18

<b>World Heritage Site</b>	<b>Number of Mining Concessions overlapping WHS</b>	<b>Estimated area of WHS overlapped by mining concessions (sq. Km)</b>
<b>Indonesia</b>	<b>52</b>	<b>2,699.30</b>
Lorentz National Park	25	2,518.18
Tropical Rainforest Heritage of Sumatra	27	181.12
<b>Mongolia; Russian Federation</b>	<b>1</b>	<b>130.83</b>
Uvs Nuur Basin	1	130.83
<b>Namibia</b>	<b>17</b>	<b>2,053.78</b>
Namib Sand Sea	17	2,053.78
<b>New Zealand</b>	<b>13</b>	<b>189.69</b>
Te Wahipounamu – South West New Zealand	13	189.69
<b>Peru</b>	<b>24</b>	<b>46.51</b>
Huascarán National Park	21	37.58
Río Abiseo National Park	3	8.93
<b>Philippines</b>	<b>5</b>	<b>55.16</b>
Mount Hamiguitan Range Wildlife Sanctuary	5	55.16
<b>Sweden</b>	<b>1</b>	<b>15.79</b>
Laponian Area	1	15.79
<b>Thailand</b>	<b>1</b>	<b>6.79</b>
Thungyai - Huai Kha Khaeng Wildlife Sanctuaries	1	6.79
<b>Uganda</b>	<b>21</b>	<b>577.67</b>
Bwindi Impenetrable National Park	10	146.34
Rwenzori Mountains National Park	11	431.33
<b>United Republic of Tanzania</b>	<b>57</b>	<b>4,595.93</b>
Selous Game Reserve	57	4,595.93
<b>Venezuela (Bolivarian Republic of)</b>	<b>1</b>	<b>3.16</b>
Canaima National Park	1	3.16
<b>Zimbabwe</b>	<b>1</b>	<b>207.92</b>
Mana Pools National Park, Sapi and Chewore Safari Areas	1	207.92
<b>Total</b>	<b>444</b>	<b>17,922.60</b>

**Table 2** - A table showing mining concessions identified to be overlapping natural WHS.

## Oil and Gas Concessions

In total 77 oil and gas concessions were identified as significantly ( $\geq 5\text{Km}^2$ ) overlapping the boundaries of 40 / 184 (21.74%) natural WHS, subsequently 144 / 184 (78.26%) natural WHS had no or marginal overlap (Table 3). Due to data coverage gaps in the DrillingInfo database and the version of the IUCN and UNEP-WCMC WDPAs utilised in the analysis, it was not possible to evaluate the overlap of oil and gas concessions for 45 (19.65%) of the 229 natural WHS (Appendix 2 and 5).

World Heritage site	Number of Oil and Gas concessions overlapping WHS	Estimated area overlapped by oil and gas concession (sq. Km)
<b>Argentina</b>	<b>1</b>	<b>130.63</b>
Ischigualasto / Talampaya Natural Parks	1	130.63
<b>Australia</b>	<b>10</b>	<b>2,247.39</b>
Gondwana Rainforests of Australia	2	387.86
Greater Blue Mountains Area	3	1,286.34
Kakadu National Park	2	25.00
Ningaloo Coast	2	230.81
Purnululu National Park	1	317.38
<b>Belize</b>	<b>1</b>	<b>30.37</b>
Belize Barrier Reef Reserve System	1	30.37
<b>Brazil</b>	<b>1</b>	<b>17.84</b>
Discovery Coast Atlantic Forest Reserves	1	17.84
<b>Central African Republic</b>	<b>1</b>	<b>9,648.80</b>
Manovo-Gounda St Floris National Park	1	9,648.80
<b>China</b>	<b>11</b>	<b>3,006.34</b>
China Danxia	1	276.35
Mount Emei Scenic Area, including Leshan Giant Buddha Scenic Area	1	7.86
Sichuan Giant Panda Sanctuaries - Wolong, Mt Siguniang and Jiujin Mountains	3	1,874.44
South China Karst	4	454.28
Wulingyuan Scenic and Historic Interest Area	1	246.77
Xinjiang Tianshan	1	146.65
<b>Congo; Cameroon; Central African Republic</b>	<b>1</b>	<b>4,101.78</b>
Sangha Trinational	1	4,101.78
<b>Democratic Republic of the Congo</b>	<b>6</b>	<b>35,040.94</b>
Salonga National Park	4	30,143.93
Virunga National Park	2	4,897.01
<b>India</b>	<b>1</b>	<b>2,761.97</b>
Western Ghats	1	2,761.97
<b>Indonesia</b>	<b>4</b>	<b>1,810.75</b>
Lorentz National Park	1	1,156.72
Tropical Rainforest Heritage of Sumatra	3	654.03
<b>Kenya</b>	<b>4</b>	<b>760.83</b>
Kenya Lake System in the Great Rift Valley	2	333.37
Lake Turkana National Parks	2	427.46

<b>World Heritage site</b>	<b>Number of Oil and Gas concessions overlapping WHS</b>	<b>Estimated area overlapped by oil and gas concession (sq. Km)</b>
<b>Lesotho; South Africa</b>	<b>1</b>	<b>965.22</b>
Maloti-Drakensberg Park	1	965.22
<b>Madagascar</b>	<b>1</b>	<b>776.84</b>
Tsingy de Bemaraha Strict Nature Reserve	1	776.84
<b>Malawi</b>	<b>1</b>	<b>73.55</b>
Lake Malawi National Park	1	73.55
<b>Mongolia; Russian Federation</b>	<b>1</b>	<b>538.50</b>
Uvs Nuur Basin	1	538.50
<b>Namibia</b>	<b>1</b>	<b>1,567.12</b>
Namib Sand Sea	1	1,567.12
<b>Nepal</b>	<b>1</b>	<b>483.67</b>
Chitwan National Park	1	483.67
<b>Netherlands; Denmark; Germany</b>	<b>12</b>	<b>2,908.01</b>
The Wadden Sea	12	2,908.01
<b>Niger</b>	<b>5</b>	<b>24,956.25</b>
Air and Ténéré Natural Reserves	4	24,901.66
W National Park of Niger	1	54.59
<b>Romania</b>	<b>1</b>	<b>66.13</b>
Danube Delta	1	66.13
<b>Senegal</b>	<b>1</b>	<b>210.22</b>
Djoudj National Bird Sanctuary	1	210.22
<b>South Africa</b>	<b>7</b>	<b>3,399.48</b>
Cape Floral Region Protected Areas	1	645.63
iSimangaliso Wetland Park	4	2,438.17
Vredefort Dome	2	315.69
<b>Tunisia</b>	<b>2</b>	<b>124.42</b>
Ichkeul National Park	2	124.42
<b>Ukraine; Germany; Slovakia</b>	<b>1</b>	<b>11.12</b>
Primeval Beech Forests of the Carpathians and the Ancient Beech Forests of Germany	1	11.12
<b>United Republic of Tanzania</b>	<b>1</b>	<b>1,766.51</b>
Selous Game Reserve	1	1,766.51
<b>Total</b>	<b>77</b>	<b>97,404.68</b>

**Table 3** – A table showing oil and gas concessions identified to be overlapping natural WHS.

## Oil and Gas Assets

In addition to assessing oil and gas concessions, it was possible in some cases to review the spatial location of oil and gas assets such as oil and gas pipelines and historical and active wells against natural WHS.

### Oil and Gas Pipelines

In total three pipelines were identified as significantly ( $\geq 1\text{Km}$ ) overlapping the boundaries of two natural WHS (Table 4).

World Heritage site	Pipeline ID	Development Stage	Estimated overlap with natural WHS (Km)
Atlantic Forest Southeast Reserves	1107	Operating	4.96
Kenya Lake System in the Great Rift Valley	2198	Ongoing	10.85
	2199	Ongoing	13.14
<b>Total</b>			<b>28.95</b>

**Table 4** – A table showing oil and gas pipelines identified overlapping natural WHS.

### Oil and Gas Wells

In total, 76 oil and gas wells were identified within boundaries of 11 natural WHS (Table 5). The vast majority of these wells are ‘Plugged & Abandoned’. These wells are no longer in use, as the operator’s interests have been intentionally relinquished often because the well is dry, inoperable or unproductive. ‘Completed’ refers to wells where drilling is complete, and are considered ‘active’, regardless of production, until officially plugged or abandoned. It should be noted that additional wells not recorded in the source data may also be present within the oil and gas concessions identified significantly overlapping natural WHS (Table 3).

World Heritage Site	Well Status	Number of Wells
Air and Ténéré Natural Reserves	Plugged & Abandoned	2
Danube Delta	Plugged & Abandoned	1
Discovery Coast Atlantic Forest Reserves	Completed	9
	Not available	1
	Plugged & Abandoned	10
Great Barrier Reef	Plugged & Abandoned	4
iSimangaliso Wetland Park	Plugged & Abandoned	3
Islands and Protected Areas of the Gulf of California	Completed	1
	Plugged & Abandoned	10
Ningaloo Coast	Plugged & Abandoned	1
Selous Game Reserve	Plugged & Abandoned	1
Te Wahipounamu – South West New Zealand	Plugged & Abandoned	2
The Wadden Sea	Plugged & Abandoned	6
Tropical Rainforest Heritage of Sumatra	Completed	1
	Plugged & Abandoned	24
<b>Total</b>		<b>76</b>

**Table 5** – A table showing oil and gas wells identified overlapping natural WHS.

## Summary of extractive activity within natural World Heritage sites

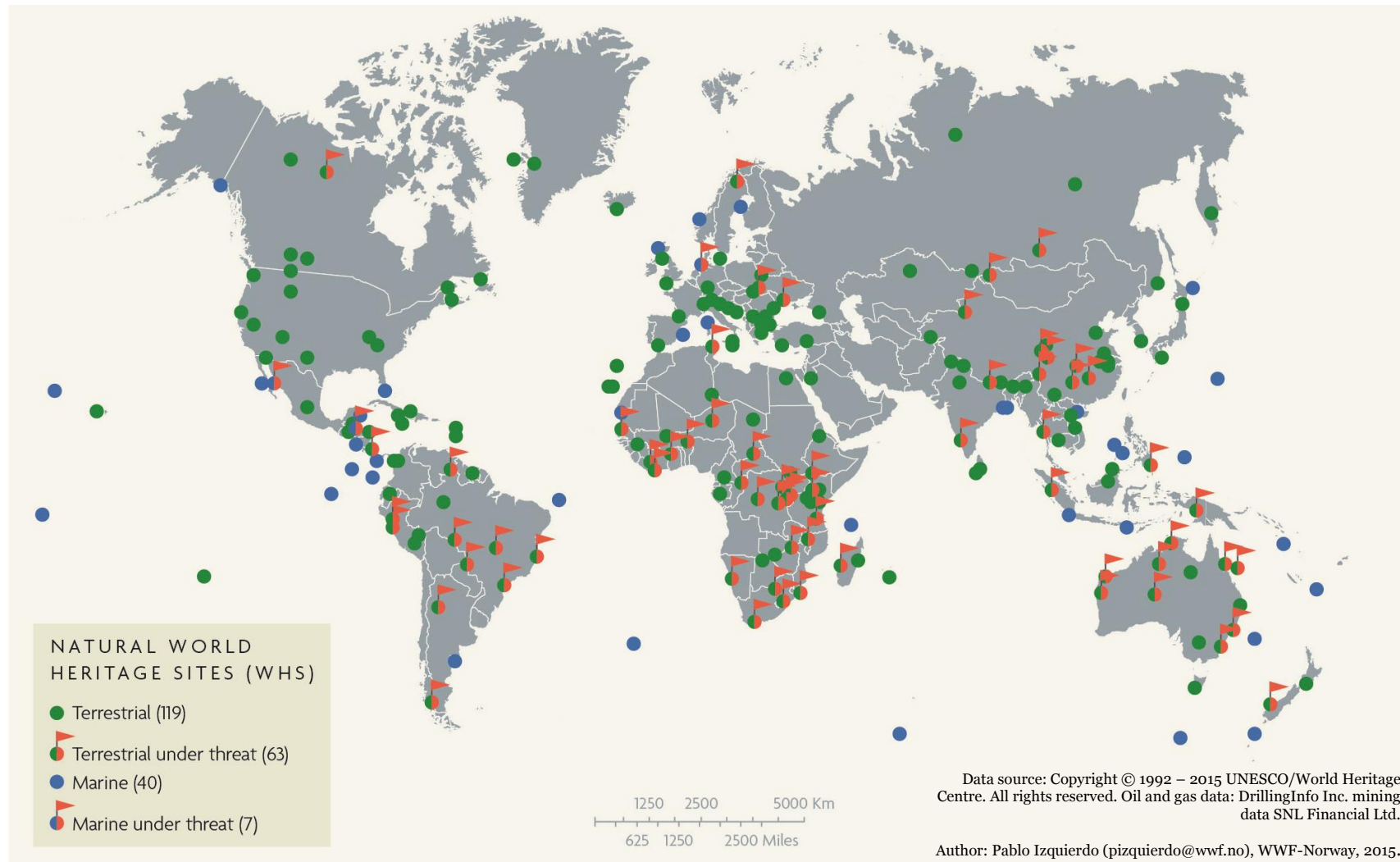
In total, 70 (30.56%) natural WHS were identified as having significant extractive activity within their boundaries (Table 6).

Region	No. of natural WHS	No. of WHS overlapped by extractive concession/s and or activity (%)	WHS with Mine/s	WHS with Mining Concession/s	WHS with Oil and Gas Concession/s	No. of Mining Concession/s identified within WHS	Estimated Mining Concession Overlap with WHS (Sq. Km)	No. of Oil and Gas Concession/s identified within natural WHS	Estimated Oil & Gas Concession Overlap with WHS (Sq. Km)	WHS with Oil and Gas Pipelines	WHS with Oil and Gas Wells
Africa	41	25 (61%)	3	11	17	196	12,387.38	30	83,267.54	1	3
Arab States	6	1 (17%)	0	0	1	0	0	2	124.42		
Asia and the Pacific	70 <sup>17</sup>	24 (34%)	5	15	16	121	4,298.15	28	10,848.62		4
Europe and North America	71	7 (10%)	3	2	3	6	29.40	14	2,985.26		2
Latin America and the Caribbean	41	13 (31%)	1	10	3	121	1,207.67	3	178.84	1	2
<b>Total</b>	<b>229</b>	<b>70 (31%)</b>	<b>12</b>	<b>38</b>	<b>40</b>	<b>444</b>	<b>17,922.60</b>	<b>77</b>	<b>97,404.68</b>	<b>2</b>	<b>11</b>

**Table 6** – A table providing a summary of extractive activity identified within natural WHS grouped by UNESCO World regions.

<sup>17</sup> The natural WHS 'Uvs Nuur Basin' is a trans-regional site, located across the Europe and Asia and the Pacific region; following UNESCO's delineation, the property is counted here as within the Asia and the Pacific region.

**Figure 1** – A map showing natural WHS potentially threatened or impacted by extractive activity as defined by WWF’s assessment.<sup>18</sup>



<sup>18</sup> The results displayed here only highlight extractive activity where data was available. For North America and Russia we were only able to access minimal data. For a detailed overview of the mining and oil and gas concession data coverage, please see the Appendix 1-5.



## Discussion

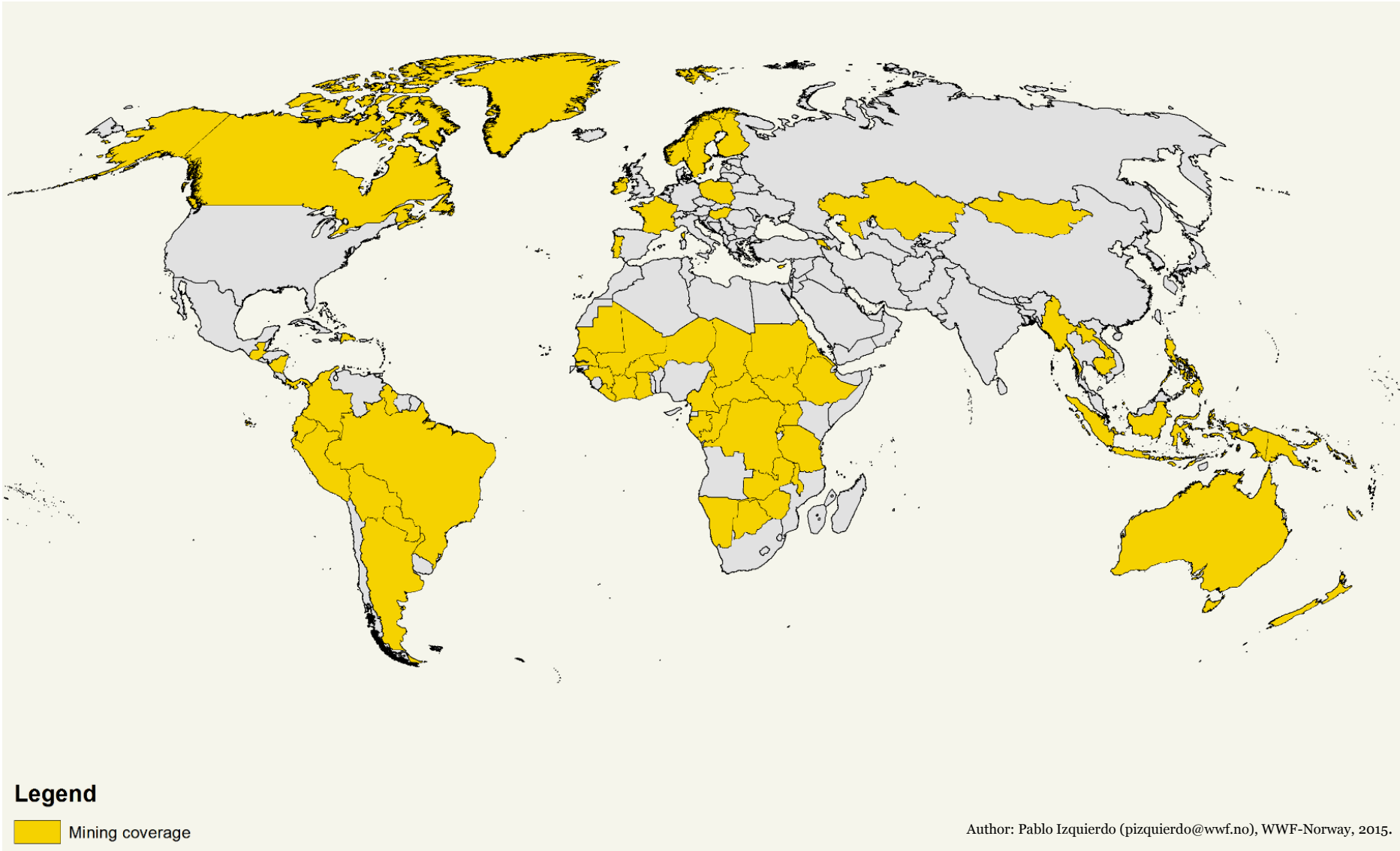
Overall, 70 / 229 natural WHS (30.56%) were identified as having some form of extractive activity within their boundaries (Table 6; Figure 1). Interestingly, it appears that natural WHS in some regions, such as Africa, are more likely to be impacted by extractive activity. While this may be the case, the extent of these regional differences inferred from the results is likely to be biased to some extent as a result of unequal regional data omissions within the source data.

**Despite the limitations of the research, at time of publication, it arguably provides one of the most comprehensive overviews of the issue to date, identifying a significant volume of extractive activity within natural WHS.** Out of the natural WHS which could be analysed, 38% (38 / 100 WHS) contained mining concessions, 21.74% (40 / 184 WHS) contained oil and gas concessions and 5.31% (12 / 226 WHS) contained mining projects. Overall, 30.56% (70 / 229 WHS) have been identified with one or multiple forms of significant extractive activity within their boundaries. It is important to recognise that these results are most likely a significant underestimate of the true extent of extractive activity in natural WHS considering the extensive data gaps within the source data (Appendix 1 – 5) and the conservative interpretation of the data.

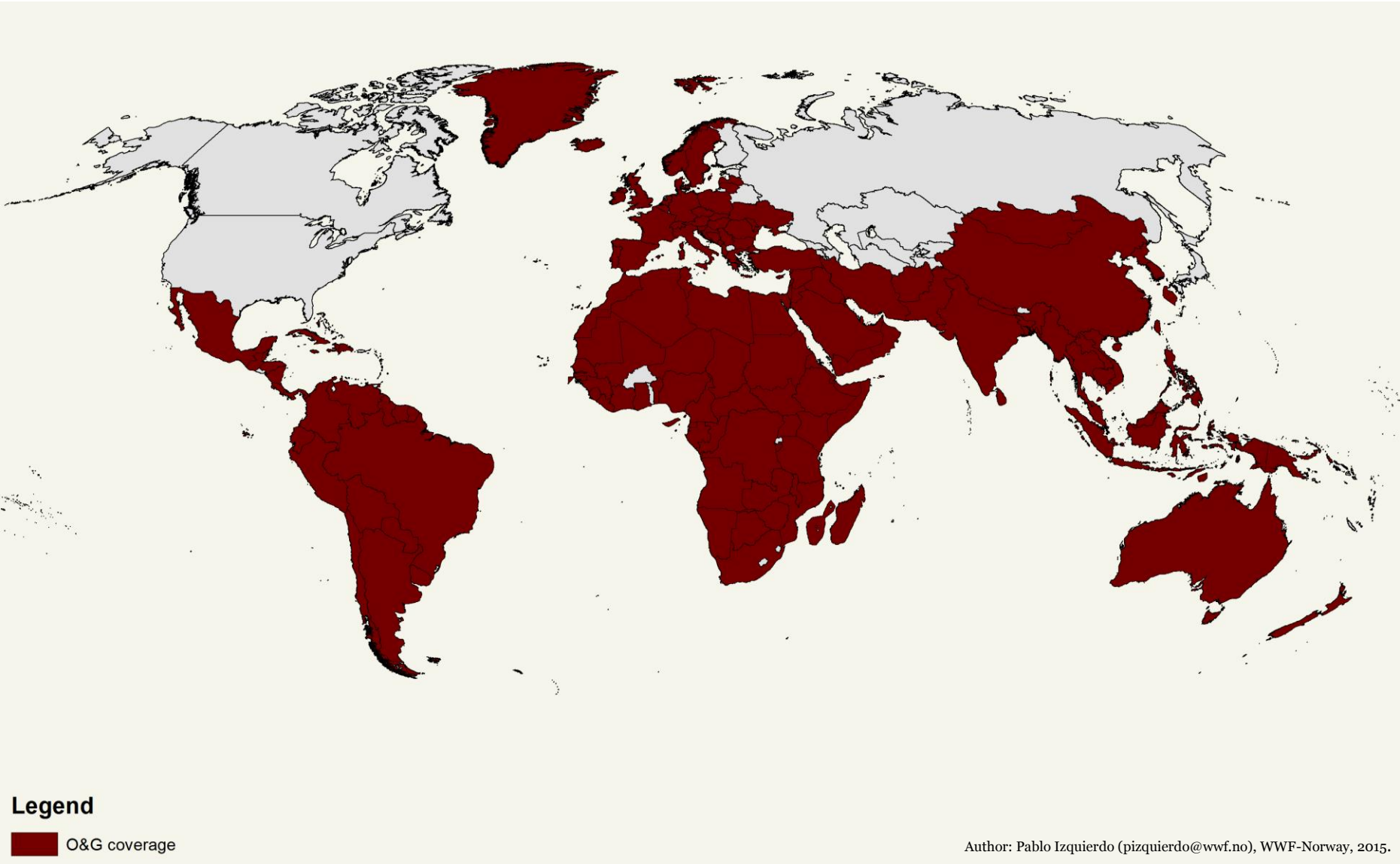
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**Appendix 1** – A map showing mining concession data coverage by jurisdiction. Data correct as of 11<sup>th</sup> August 2015.



**Appendix 2** – A map showing oil and gas concession data coverage by jurisdiction. Data correct as of 20<sup>th</sup> July 2015.






**Appendix 4** – A table defining coverage of mining concessions by jurisdiction. Data correct as of 11<sup>th</sup> August 2015.

<b>Jurisdiction</b>	
Alaska	Ireland
Argentina - Catamarca	Kazakhstan
Argentina - Chubut	Laos
Argentina - Jujuy	Liberia
Argentina - La Rioja	Malawi
Argentina - Neuquen	Mali
Argentina - Rio Negro	Mauritania
Argentina - Salta	Mongolia
Argentina - San Juan	Myanmar
Argentina - Santa Cruz	Namibia
Armenia	New Caledonia
Australia	New Zealand
Bolivia	Nicaragua
Botswana	Niger
Brazil	Norway
Burkina Faso	Panama
Cambodia	Papua New Guinea
Cameroon	Paraguay
Canada	Peru
Central African Republic	Philippines
Chad	Poland
Colombia	Portugal
Congo	Rwanda
Côte d'Ivoire	Senegal
Cyprus	Solomon Islands
Democratic Republic of the Congo	Sudan
Dominican Republic	Sweden
Ecuador	Tanzania
Eritrea	Uganda
Ethiopia	United Kingdom - Northern Ireland
Fiji	Zambia
Finland	Zimbabwe
Gabon	
Ghana	
Greenland	
Guatemala	
Guinea	
Hungary	
Indonesia	

**Appendix 5** – A table defining coverage of oil and gas concessions by jurisdiction. Data correct as of 20<sup>th</sup> July 2015.

<b>Jurisdiction</b>						
Afghanistan	Chad	France	Jordan	Nepal	Seychelles	Tunisia
Albania	Chile	French Guiana	Juan De Nova Island	Netherlands	Sierra Leone	Turkey
Algeria	China	Gabon	Kenya	New Zealand	Slovakia	Uganda
Angola	Colombia	Germany	Kuwait	Nicaragua	Slovenia	Ukraine
Argentina	Comoros	Ghana	Laos	Niger	Somalia	United Arab Emirates
Aruba	Congo	Greece	Latvia	Nigeria	Somaliland	United Kingdom
Australia	Congo (Dem Rep)	Greenland	Lebanon	North Korea	South Africa	Uruguay
Austria	Costa Rica	Grenada	Liberia	Norway	South Korea	Venezuela
Bahamas	Cote D'Ivoire	Guadeloupe	Libya	Oman	South Korea JDZ	Vietnam
Bahrain	Croatia	Guatemala	Lithuania	Pakistan	South Sudan	Western Sahara
Bangladesh	Cuba	Guinea	Madagascar	Palau	Spain	Yemen
Barbados	Cyprus	Guinea-Bissau	Malawi	Panama	Sri Lanka	Zambia
Belgium	Czech Republic	Guyana	Malaysia	Papua New Guinea	St Lucia	Zimbabwe
Belize	Denmark	Haiti	Malaysia Thailand Joint Development Area	Paraguay	St Vincent	
Benin	Divided Zone	Honduras	Mali	Peru	Sudan	
BES Islands	Djibouti	Hungary	Malta	Philippines	Suriname	
Bolivia	Dominican Republic	Iceland	Martinique	Poland	Sweden	
Bosnia & Herzegovina	Ecuador	India	Mauritania	Portugal	Switzerland	
Botswana	Egypt	Indonesia	Mexico	Qatar	Syria	
Brazil	Equatorial Guinea	Iran	Moldova	Romania	Taiwan	
Brunei	Eritrea	Iraq	Mongolia	Sao Tome & Nigeria	Tanzania	
Bulgaria	Ethiopia	Ireland	Montenegro	Sao Tome & Principe	Thailand	
Burundi	Europa & Bassas	Israel	Morocco	Saudi Arabia	The Gambia	
Cambodia	Falklands (Malvinas)	Italy	Mozambique	Senegal	Timor	
Cameroon	Faroe Islands	Jamaica	Myanmar	Senegal Guinea Bissau Joint Development Zone	Tonga	
Central African Rep	Fiji	Joint Petroleum Development Area Timor Sea	Namibia	Serbia	Trinidad & Tobago	

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